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Air Brake and Train Handling Rules

The rules become effective at 0001, Thursday, April1, 2004. At that time, all previous rules and instructions that are inconsistent with these rules become void.

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30.0 Train Air Brake Tests and Inspections

30.1 Compliance with FRA Regulations

Inspect and test brake equipment on locomotives and cars according to Federal Railroad Administration (FRA) regulations contained within these rules.

30.2 Safety Inspection of Freight Cars

Inspect and test brake equipment on locomotives and cars according to Federal Railroad Administration (FRA) regulations contained within these rules. In addition, all cars at the initial terminal or that are added enroute must be given a safety inspection as per General Code of Operating Rules (GCOR) Rule 1.33.

Inspections and air brake tests must be performed by either a "Qualified Person" or a "Qualified Mechanical Inspector".

A "Qualified Person" refers to a trainman given fundamental training on freight car inspections and air brake tests and a "Qualified Mechanical Inspector" refers to a person such a carman who has been given more extensive training that provides for a more detailed inspection. All train and engine personnel are "Qualified Persons" in the application of the following rules.

Inspection and air brake tests by Qualified Mechanical Inspectors provide for a greater distance that a train may travel before additional inspections and tests are required.

Inspection of equipment, when required, must be performed on both sides at some point during an inspection and air brake test to be able to examine and observe the functioning of the brake system on each car. Roll-by inspections do not constitute a safety inspection for either side of a train.

30.3 Coupling and Securing Air Hoses

Before coupling air hoses between locomotives and/or cars, employees must:

- Shake debris out of the hoses.
- Blow all condensation from the locomotive brake pipe or yard air line.

Whenever practicable, secure air hoses on locomotives and cars during all movements to prevent the hoses and glad-hands from dragging and becoming damaged.

30.4 Operative Brakes

These requirements apply to air brake tests and inspections:

- Unless brakes fail enroute, air brakes on all cars must be operative unless being moved for repairs and properly tagged on both sides by a Qualified Mechanical Inspector.

  Exception: Scale test cars are not required to be equipped with air brakes, but if equipped must be operable.

- Cars discovered with brakes that fail enroute must be tagged on both sides and noted on space provided on train documentation and left in controlling locomotive cab form holder for relieving crew. Notify dispatcher or mechanical help desk.
- Train documentation may also reflect such cars by electronic means to subsequent crews after defective brakes are initially discovered and reported.
- At least 85 percent of the cars in a train must have operative brakes under all circumstances.
- When departing terminals, engineers must allow their trains to be inspected where required.

30.5 Person in Charge During Air Brake Test

The person performing the air brake test is in charge of the train while the test is being conducted. Before permission is given to apply or release the brakes, the person in charge must determine that all employees are safely positioned.

The employee at the controls of the locomotive must not apply or release train brakes without permission from the person performing the air brake test.

30.6 Standard Brake Pipe Pressures

Regulating valve must be set as follows:

- Yard or Freight service - 90 psi.
- Trains consisting entirely of business car or passenger equipment - 105 psi.

Note: Amtrak and Commuter Trains will be governed by their own instructions.

30.7 Charging Air Brake System

Charge the air brake system to ensure that the system functions as needed. When charging the system:

- Do not charge a train's air brake system with more than one automatic brake valve cut in unless utilizing distributed power locomotives.
- Do not increase diesel engine RPM to maintain main reservoir pressure unless the pressure fails to stay 10 psi above the regulating valve setting.
- If engine RPM must be increased, do not exceed throttle position 4. Locomotives equipped with electric air compressors may only require Run 1 for maximum efficiency.
- If using a remote control locomotive the charge feature on the remote control transmitter should be used.

In yards where trains are made up, unattended locomotives may be used to charge the brake system.

30.8 Air Brake Tests Using End-of-Train Telemetry Devices (EOT)

When air brake test requires determining brake pipe pressure is restored or air brake system is to be charged to a specified pressure at the rear end of train, this may be determined by any of the following:

- An accurate gauge.
- An EOT.
- A distributed power locomotive consist.

When an air brake test requires an inspection to determine that the brakes apply and release on the rear car of the train, this requirement is considered fulfilled when either an EOT or a distributed power consist attached to the rear of the train indicates the following:

- A brake pipe pressure decrease of at least 5 psi, the brakes are applied.
- A brake pipe pressure increase of at least 5 psi, the brakes are released.

30.9 Brake Pipe Leakage Test

30.9.1 Air Flow Method (AFM)

AFM is the preferred method to test brake pipe leakage. To qualify a train's air brake system using AFM, the train must be equipped as follows:

- The controlling locomotive has a maintaining-type automatic brake valve.
- The train has a gauge or device at the rear of the train.
- The locomotive has an air flow indicator with a direct reading of air flow in increments no greater than 10 cubic feet per minute (CFM).

Conduct an AFM test as follows:

1. Charge the brake system to within 15 psi of the regulating valve setting as indicated by a gauge or device at the rear of the train.

2. When air flow does not exceed 60 CFM, test is complete. If air flow exceeds 60 CFM, train must be inspected for leakage, leakage corrected, and brakes re-tested.

30.9.2 Brake Pipe Leakage Method

If the train does not meet AFM test conditions conduct a brake pipe leakage test as follows:

1. Charge the brake system to within 15 psi of the regulating valve setting as indicated by a gauge or device at the rear of the train.
2. Wait for the signal to apply the brakes.
3. When the signal is received, reduce brake pipe pressure by 20 psi.
4. Allow the brake pipe exhaust to stop.
5. Wait 1 minute.
6. Cut out the automatic brake valve maintaining feature.
7. Wait an additional 1 minute for the brake pipe pressure to equalize
8. Time the brake pipe leakage for 1 minute. If the leakage does not exceed 5 psi the test is complete. Cut in the automatic brake valve maintaining feature. If the leakage exceeds 5 psi, the train must be inspected for leakage, leakage corrected, and re-tested.
9. When the signal to release the brakes is received, move the automatic brake valve to RELEASE position.

Note: Utilize the Distributed Power systems automated brake pipe leakage mode when checking leakage on DP trains.

30.10 Initial Terminal and Road Air Brake Test (Class 1 Air Brake Test)

A qualified employee must conduct the initial terminal air brake test (ITABT< Class 1) and a safety inspection as per Rule 1.33.

30.10.1 Requirement For Test

A. Test must be conducted:

- Where the train is originally assembled (initial terminal).
- Where the train consist is changed, other than adding or removing a car or a solid block of cars.
- Where a unit or cycle train has traveled 3,000 miles since it's last Initial Terminal Air Brake Test, Class 1.

  or

- Where the train is received in interchange and the train consist is changed. However, an inspection and test is not needed if the train consist is changed by any one or a combination of the following:

  a. Adding or removing a solid block of cars.

  b. Changing motive power.

  c. Removing or changing a caboose.

B. Test must be conducted on a portion of the train or on cars added to the train when:

- One or more cars added that have not been pre-tested by the Initial Terminal Air Brake Test, Class 1.
- That portion of the train that has not been kept charged. (off air for over 4 hours).
- A solid block of cars being added to the train is comprised of cars from more than one previous train.
- Each solid block of cars from only one previous train which has not remained continuously and consecutively coupled together with the train line remaining connected except:

  a. For removing defective equipment from the solid block since being removed from it's previous train.

  b. When track length at time solid block was removed from the previous train will not hold the entire solid

block of cars and cars are re-coupled in the same relative order as removed.

30.10.2 Procedure for Initial Terminal and Road Air Brake Test and Inspection

Inspect before or during Air Brake Test for the following:

- Inspect the angle cocks and verify that they are properly positioned.
- Inspect the air hoses and verify that they are in condition for service and properly coupled.
- Inspect the system for leakage.
- Make necessary repairs to reduce leakage to a minimum.
- Inspect the retaining valves and verify that they are in EXHAUST.

Conduct the test as follows:

1. Charge the air brake system to within 15 pounds of the locomotive regulating valve setting as indicated by a gauge or device at the rear of the train.
2. When proper notification is received to apply the brakes for the test, make a 20 pound brake pipe reduction.
3. Perform a leakage test as specified in Rule 30.9 (Brake Pipe Leakage Test).
4. Inspect the entire train or cars added not pre-tested to determine that:
    - Brakes are applied and remain applied until signal is given to release on each car and piston travel meets the requirements of Rule 30.18 (Piston Travel). 100 percent of the train brakes must be operative before departing. Any car whose brakes release prior to signal given to release the brakes may be re-tested once. On retest the brakes must remain applied for at least 3 minutes. Release will be initiated after the 3 minute period.
    - Brake rigging does not bind or foul.

- All parts of the brake equipment are properly secured.

When the test and inspection of the air brake application is complete and the proper notification has been received to release the brakes:

- Place the automatic brake valve handle in the RELEASE position.
- Notify the inspector that the brakes have been released.
- Inspect each brake to make sure all brakes have released. This inspection may be made as the train departs at a speed not exceeding 10 MPH.

Note: An EOT pressure drop and rise of 5 psi during the air brake test may be used to determine application and release of cars within the train that have been previously tested.

30.10.3 Engineer Notification

A qualified person or mechanical inspector who participated in the test and inspection or anyone who knows the test was completed must notify the engineer in writing that the initial terminal air brake test has been completed satisfactorily including name of inspector, date, time, location and number of cars inspected. When Class 1 inspections and tests are communicated to the engineer, the required information must be entered in the space provided on train documentation.

Engineers receiving written notification of the air brake test must:

- Accept the notification as authority that the initial terminal air brake test has been completed satisfactorily.
- Leave written notification on the controlling locomotive. This written notice must include name of inspector, date, time, location and number of cars inspected. Written notification of the initial terminal inspections and air brake tests may be provided to the locomotive engineer by any one of the following methods:

a. Air Brake Test Form provided at the initial terminal.

Note: If controlling locomotive is changed enroute, place Air Brake Test Form on new controlling locomotive.

b. Written record in space provided on train documentation, if test was performed by a train crew member. (Qualified Person)

Note: Any written record is acceptable, if train documentation is unavailable.

c. By electronic means in the space provided on the train documentation.

30.10.4 Cycle Trains

Bulk commodity unit commodity trains (coal, grain, taconite, etc.) that remain intact are considered "Cycle Trains". These trains may not be operated more than 3,000 miles before another Initial Terminal Air Brake Test (Class 1) is required. However, the 1,000 Mile Inspection (Class 1A) must be performed each 1,000 miles as required. A bulk commodity unit train that is designated as "Extended Haul", will be governed by the Extended Haul rules and will require a 1,500 mile air brake test per Rule 30.10.1.

30.10.5 Trains Designated as "Extended Haul"

Trains designated as "Extended Haul" must be given air brake inspection and tests performed by a Qualified Mechanical Inspector and train may be operated greater than 1,000 miles but not to exceed 1,500 miles before an additional Intermediate or Initial Terminal Inspection and Air Brake Test, Class 1 is required. To apply the extended distance for this type of inspection and air brake test:

- Train may not make more than one pick up and one set out between Initial Terminal (Class 1) and/or Intermediate (Class 1A) inspection points. This excludes any set out of defective equipment discovered enroute.
- Any set out enroute must be given an inbound inspection by a Qualified Mechanical Inspector.
- Any cars or solid block of cars added enroute must be pretested by a Qualified Mechanical Inspector.
- Train must not move any cars with defective equipment, regardless of whether tagged appropriately.

- Train must be given inbound inspection by a Qualified Mechanical Inspector at 1,500 mile intermediate inspection points.

30.10.6 Test Required after attaching locomotive to train previously Tested with Yard Test Plant or other locomotive

When the locomotive is coupled to a train that the Initial Terminal Air Brake Test, Class 1, has been performed with yard test plant, do one of the following that applies:

- If train has been off air 4 hours or less and yard air pressure setting is the same as locomotive regulating valve, perform air test as outlined in Rule 30.15 (Application and Release Test, Class 3).

- If train has been off air 4 hours or less, and yard air pressure setting is less than locomotive regulating valve.

  1. Charge air to regulating valve setting.

  2. Perform a leakage test as specified in Rule 30.9 (Brake Pipe Leakage Test).

  3. Perform a Rule 30.15 (Application and Release Test, Class 3).

- If train has been off air more than 4 hours perform a Rule 30.10 (Initial Terminal Air Bake Test, Class 1) on the entire train.

30.11 Transfer Train Movements Test

A train making transfer movements that does not exceed 20 miles in one direction is considered a transfer train. Intermediate switching is permitted on Transfer Train movements.

Test the air brake system on a transfer train as follows:

1. Couple brake pipe hoses between all cars.

2. Charge the brake system to at least 60 psi as indicated by a gauge or device at the rear of the train.

3. Make a 15 psi brake pipe reduction.

4. Verify that the brakes apply and remain applied on each car until release signal is given. Any car whose brakes release prior to signal given to release the brakes may be re-tested once. On retest, the brakes must remain applied for at least 3 minutes. Release will be initiated after the 3-minute period.

Note: Cars added to the transfer train must be tested as outlined above at that location before proceeding. If cars are set out during a transfer train and yard movement, determine that brake pipe pressure at the rear car has been restored before proceeding.

30.12 1000 Mile Inspection Tests (Class 1A Brake Test)

At designated locations, conduct a 1000 Mile Inspection train air brake test as follows:

1. Perform a leakage test as specified in Rule 30.9 (Brake Pipe Leakage Test).

2. With the automatic brake valve, make a 20 psi brake pipe reduction and verify that brakes apply and remain applied on each car until release signal is given. Any car whose brakes release prior to signal given to release the brakes may be re-tested once. On retest, the brakes must remain applied for at least 3 minutes. Release will be initiated after the 3 minute period.

3. Verify that the brake rigging is properly secured and does not bind or foul.

4. Verify that 100 percent of the air brakes are operative before proceeding.

30.13 Running Air Brake Test

30.13.1 Requirements For Test

Conduct a running air brake test of all passenger trains and trains consisting entirely of business cars when:

- The train leaves the initial terminal.
- Locomotive, engine crew, train crew or operating ends have been changed.
- Any angle cocks or cutout cocks have been closed.

- A standing air brake test has been conducted.
- The train reaches points designated by the timetable.

or

- The train has struck debris on the track.

30.13.2 Procedure for Running Air Brake Test

To conduct a running air brake test:

1. Begin the running test of the brakes as soon as train speed is high enough to prevent stalling.
2. While using enough power to keep the train stretched:
   a. Apply the train brakes with enough force to make sure the train brakes are operating properly.
   b. Keep the locomotive brakes released during the test.
   c. Verify that the train brakes create a noticeable retarding force.
3. If the train brakes are operating properly, release the brakes and proceed.

Note: Do not apply the locomotive or dynamic brakes during a running test. If the train fails this test, stop immediately and make repairs.

30.13.3 Brakes Not Operating Properly

If the train brakes are not operating properly, stop the train immediately and:

1. Inspect the brakes to identify and correct the problem.
2. Before proceeding, conduct an application and release test a specified in Rule 30.15 (Application and Release Test, Class 3).
3. Once the train is proceeding, immediately repeat the running test.

30.14 Test When Cutting Off and Recoupling

When a train is uncoupled, air brakes unchanged and recoupled in 4 hours or less, brake pipe pressure must be restored as indicated by gauge or device at the rear end of the train before proceeding.

If the cars are recoupled in more than 4 hours, conduct a Rule 30.10 (Initial Terminal Air Brake Test, Class 1) on those cars that did not remain charged.

30.15 Application and Release Test (Class 3 Brake Test)

30.15.1 Requirement For Test

Test must be conducted when:

- Any change is made to a locomotive consist.
- A caboose is changed.
- Picking up a block of previously tested cars.
- Helper locomotives are added anywhere in the train or removed from other than the rear end of the train.

  or

- One or more consecutive cars are set out of the train.

30.15.2 Procedure for Conducting An Application and Release Test

To conduct an application and release test:

1. Charge the brake system to within 15 psi of the regulating valve setting as indicated by a gauge or device at the rear of the train.
2. Make a 20 psi brake pipe reduction with the automatic brake valve.
3. Verify that brakes on the rear car apply and release.

30.16 Air Brake Test When Adding Pretested Cars

When adding a block of cars pre-tested by Rule 30.10 (Initial Terminal Air Brake Test, Class 1) that have been off air 4 hours or less, conduct a Rule 30.15 (Application And Release Test, Class 3).

30.17 Inbound Train Inspection

At terminals where facilities are available for immediate air brake inspections and repairs:

1. Secure cars with sufficient hand brakes as required.
2. Place the automatic brake valve handle in the HANDLE OFF position, and make a 70 pound brake pipe reduction.
3. Place the handle in the SUPPRESSION position to stop the brake pipe reduction.
4. When the brake pipe reduction is complete and the air has stopped exhausting, close the angle cock on the locomotive or on the cars that will be detached with the locomotive.
5. Make sure the angle cock on the portion of the train or cars left standing is left open.

30.18 Piston Travel Limits

Follow the piston travel requirements as outlined by stenciling or badge plate. If no stenciling or badge plate is available, piston travel must be within the following guidelines:

30.18.1 Truck-Mounted Brake Cylinders

- Piston travel must provide brake shoe clearance when brakes are released.
- Piston travel must not exceed 4 inches where the piston acts directly on the brake beam.

30.18.2 Body-Mounted Brake Cylinders

At the initial terminal the piston travel must be adjusted to between 7 and 9 inches.

At intermediate inspection points the piston travel must not exceed 10 ½ inches.

30.19 Dynamic Brakes

30.19.1 Dynamic Brake Requirements

Locomotives discovered to have inoperative dynamic brakes must be individually tagged and an additional defect tag must be left on the controlling locomotive of the locomotive consist as information to the locomotive engineer. Inoperative dynamic brake information may also be provided to the locomotive engineer by electronic means on the train documentation under locomotive information, which will show for each locomotive whether locomotive dynamic brake is "operative".

The requirement to identify inoperative dynamic brakes only includes dynamic brakes that are defective or ineffective due to malfunction and does not include tagging dynamic brakes that are simply cut out to comply with dynamic brake axle limitations.

Tags indicating inoperative dynamic brakes should include the following information:

1. Locomotive number.
2. Name of discovering railroad.
3. Location and date condition discovered.
4. Signature of person discovering the condition.

30.19.2 Inoperative Dynamic Brake on Lead, Controlling Locomotive

On train movements requiring the use of the dynamic brake, the lead, controlling locomotive must be equipped with:

1. An operative dynamic brake.

   or

2. An operative accelerometer that displays current change in speed or predicted change in speed in miles per hour per minute.

Note: Low speed yard and transfer movements on level or near level grade are examples of movements that would not "require" the use of dynamic braking.

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31.0 Locomotive Air Brake Tests and Inspections

31.1 General Requirements

When locomotive inspection forces are not immediately available, an engineer taking charge of a locomotive consist must know that the brakes are in operating condition.

Engineers are responsible for the following:

1. If possible, position yourself so you can conduct a roll-by inspection of an incoming locomotive consist.
2. Keep the side and end doors of the locomotive closed when the doors are not being used.
3. Keep cab windows and doors of unoccupied trailing locomotives closed.
4. Keep the locomotive's high-voltage cabinets closed during operation.
5. Verify that brake pipe exhaust ports are not plugged or obstructed.
6. Make a visual inspection of the control cab (including the nose of the cab) for any obvious damage to devices such as speed indicators, radios, HEU's event recorder, etc., including cable connection to these devices. This visual inspection includes knowing that required systems are cut in and sealed for territory the train will operate in such as ACS or ATC.
7. Verify that the independent brake valve handle is not blocked in the actuate position.
8. Verify that the reverser is centered to engage the low-idle feature when the locomotive is not moving.
9. Verify that the brake shoes are thick enough to last until the next maintenance or through the shift in yard service.
10. Check for sliding wheels at frequent intervals if:
    - The locomotive is dead.
    - The locomotive is isolated.

or

- The locomotive's traction motors are cut out.

31.2 Locomotive Daily Inspection

31.2.1 Inspection Requirements

Engineers are responsible for ensuring that each locomotive in their charge including locomotive(s) picked up enroute is inspected each day the locomotive is in service. Determine if locomotive needs to be inspected by checking the FRA Rule 229.21 Daily & Mid-Trip Inspection form (locomotive cab card) in each locomotive cab. The card will indicate the date and time of the last inspection.

Exceptions:

- On a multiple locomotive consist engineer may assume that all trailing locomotives in the consist and any distributed power in train were inspected on the same date as the cab card on the controlling locomotive.
- An inspection is not required on a locomotive that is idling or shutdown and will not be used as a working locomotive:
- Union Pacific locomotives have an entry in the "REMARKS" section at the bottom of the blue card (Form FRA F-6180-49A) which reads "Do Not Use After: *mm/dd/yy*". Verify that the locomotive has not passed this date.

A. Inspected Previous Calendar Day

If the locomotive cab card indicates that the locomotive was inspected the previous calendar day, complete the current daily inspection before 2359 hours.

To allow the locomotive to remain in service:

- If your tour of duty will go beyond 2359 hours, conduct the locomotive daily inspection before 2359 hours. Contact the train dispatcher, yardmaster, or other proper authority to determine where to complete the daily inspection.

or

- If you have time to reach your final terminal before 2359 hours, inspect the locomotive at that terminal unless informed that the Mechanical Department or the relieving engineer will inspect the locomotive before 2359 hours:

B. Not Inspected Previous Calendar Day

If the locomotive cab card indicates that the locomotive was not inspected during the previous day, or if there is no record on the locomotive, inspect the locomotive before it is placed into service on the current day.

C. Locomotive Picked Up Enroute

When picking up a locomotive on line, the engineer must determine which locomotives will require a daily inspection. No locomotive in resulting consist may have a date older than the lead, controlling locomotive.

D. Locomotive Set Out On Line

When setting out a locomotive on line that was inspected on the previous calendar day, inspect the locomotive, unless notified that the locomotive will be inspected by the Mechanical Department or be picked up by another train before 2359 hours:

31.2.2 Conducting a Locomotive Daily Inspection

Not all defects are non-complying conditions. However, the following items are non-complying conditions if they do not function properly during the daily inspection.

Remote control locomotives must be in manual mode when conducting inspection.

Inspect these three general areas of each locomotive:

Note: B-units and units designated or modified not to be occupied, are not required to have or be equipped with all the devices included in the inspection.

A. Control Compartment/Locomotive Cab

Verify that FRA Form F 6180-49A (blue card) is displayed under a transparent cover in the cab of each locomotive.

Operate sanders to deposit sand in front of each locomotive's lead wheels using the reverser position to determine the direction.

Ensure that:

1. Each air gauge registers correctly and is within 3 psi of the required pressure. See Rule 31.7 (Standard Air Pressures).

2. At least one headlight bulb is to be operational on each end of the locomotive consist.

3. At least one of two ditch lights is operational in the direction of travel.

4. Horn operates.

5. Bell operates.

6. Gauge lights and engineer's overhead cab light illuminate. If burned out and other available lighting is sufficient to allow visibility from the crews normal position, report as a defect but not a non-complying condition.

7. Speed indicator functions accurately. After a daily inspection, if the speed indicator failure is identified on the lead locomotive as soon as it begins moving, the failure is a non-complying condition discovered during the daily inspection.

8. Locomotive cab is free of stumbling or slipping hazards.

9. Windows provide a clear view. Small cracks that do not obscure view must be reported as a defect but not a non-complying condition.

10. No traction motors have been cut out. However, on GE AC, GE-8 DC, GE-9 DC & EMD AC locomotives, one or more traction motors/trucks may be cut out and not considered a non-complying condition.

11. Cab seats are properly secured.

B. Walkway and Engine Compartment

Inspect both sides of each locomotive to ensure that:

1. Walkways and walk-in compartments (car body-type locomotives) are clear of debris, tools, and accumulated oil or grease that present a hazard to the crew.
2. Handrails, hand holds, steps, ladders, safety chains, and guards are secured and ready for service. Inspect for broken, bent, damaged, or loose equipment. Make sure safety chains are connected high enough for safe passage.
3. All electrical and rotating equipment guards are in place.
4. The diesel engine has no apparent exhaust, oil, water, or fuel leaks.
5. The hand brake is operational.

C. Ground Level

Inspect the exposed areas for apparent defects, but do not crawl under or between locomotives to make the visual inspection.

Set hand brakes, if necessary, and walk around both sides of the locomotive to ensure that:

1. Sand is deposited on the rail in front of the lead wheels of each locomotive in consist.
2. Fuel tank is not leaking.

3. No defects such as cracks and broken or missing parts are on the:

   - Locomotive trucks.
   - Wheels.
   - Gear cases.
   - Draft gears.

4. Brake cylinder piston travel is:

   - Minimum: Sufficient to provide brake shoe clearance when the brakes are released.
   - Maximum: 1-1/2 inches less than the travel entered on FRA Form F 6180-49A (blue card) in the locomotive cab.

5. Foundation brake rigging is secured and all components other than wheels and sand hoses are at least 2 1/2 inches above the top of the rail.

6. Snowplow, pilot, or endplate is properly secured and is between 3 inches and 6 inches above the top of the rail.

7. Brake shoes are secured and approximately in line with the tread of the wheel. Make sure the shoe has no obvious lips or overhangs.

8. No part of the electrical cable is lying on the coupler.

9. Unused electrical cables are stowed, or the disconnected ends are placed into a dummy receptacle or a multiple-unit cable holder.

10. Manually drain oil and water from main reservoirs that are not equipped with automatic drains. If equipped with automatic drains, ensure the valve handles are then turned fully clockwise to the automatic position, with the stem extending beyond the valve handle.

11. There is no apparent physical damage to the ATC/ACS receiver bars on locomotives equipped with ATC/ACS. These bars are located above the rail and in front of the wheels. This requirement applies only to lead locomotives on trains operating in ATC/ACS territory. Any apparent damage must be reported but this does not constitute a non-complying defect.

31.2.3 Complete Required Daily Inspection Forms

Locomotive Inspection Report

Complete an Electronic Locomotive Inspection Report for each locomotive inspected.

Locomotive daily inspection form and a FRA Rule 229.21 Daily & Mid-Trip Inspection form (cab card) must be completed with the following inspection information:

- Date.
- Location.
- Time.

Indicate "Not used" if the locomotive has not been used on a particular day, and form supplied on locomotive has calendar-type daily inspection form. The locomotive cab card must remain in the holder in the locomotive cab.

Note: Leave an original copy of the locomotive daily inspection at location designated by other instructions.

31.2.4 Locomotive With Non-complying Condition Safe To Move

If during the locomotive daily inspection you find one or more non-complying conditions, determine if the locomotive is safe to move.

If the locomotive is safe to move, it may be moved only:

- As a single locomotive under power not attached to cars.
- In a locomotive consist not attached to cars.
- Isolated or shut down when attached to cars.

Exceptions:

- Controlling locomotive found with defective speed indicator during daily inspection may be operated under power attached to cars not exceeding 20 MPH.

- Locomotives found with the following defects during the daily inspection may be operated under power attached to cars as a trailing locomotive:

  a. Inoperative headlights.

  b. Inoperative horn.

  c. Inoperative bell.

  d. Defective speed indicator.

  e. Window cracks that obscure view.

  f. Cab seats not properly secured.

  g. Both ditch lights inoperative.

Prior to moving a non-complying locomotive perform the following:

1. Complete a non-complying locomotive tag and attach it to the isolation switch of the non-complying locomotive. The tag must include the following information:

   - "Non-complying locomotive" written on the tag.
   - Locomotive initials and number.
   - Name of the inspecting railroad.
   - Inspection location and date.
   - Nature of the defect.
   - Movement restrictions, if any.
   - Destination.
   - Signature of the employee making the inspection.

2. Secure a copy of the non-complying tag on the control stand of the controlling locomotive.

3. Make sure the engineer in charge of the locomotive movement receives written notification of the non-complying locomotive (a copy of a non-complying locomotive tag meets this requirement). The engineer must inform all other crew members of the non-complying unit and of any restrictions.

4. Notify the train dispatcher/mechanical desk, yardmaster, or other proper authority.

However a locomotive may be moved as a single or dead unit within a yard solely for repairs, not to exceed 10 MPH, without complying with Items 1, 2, and 3 listed above.

31.2.5 Locomotive With Non-complying Condition Not Safe To Move

If during the locomotive daily inspection you find one or more non-complying conditions and determine the locomotive is not safe to move, do the following:

1. Notify the train dispatcher, yardmaster, or other proper authority.

2. Complete a non-complying tag and attach the tag to the isolation switch of the non-complying locomotive. The tag must include this information:

   - "Non-complying locomotive" written on the tag.
   - Locomotive initials and number.
   - Name of the inspecting railroad.
   - Inspection location and date.
   - Nature of the defect.
   - Signature of the employee making the inspection.

31.3 Defects Other Than Non-Complying Conditions

If a defect or problem is found and is not a non-complying condition do the following:

1. Complete a Locomotive Daily Inspection Report for each locomotive in the consist with a defect or problem.

2. Report any locomotive not producing power to the Mechanical Desk.

Examples of a defect or problem that is not a non-complying condition include:

- Weather stripping is defective.
- Windshield wipers are not working.
- One headlight bulb is burned out.
- Ground relay is tripped.
- Safety valve on the air compressor or main reservoir is popping off.

31.4 Non-Complying Condition Found Enroute

A locomotive that develops a non-complying condition enroute may continue operating if the engineer or other qualified employee determines the locomotive is safe to move and completes the Locomotive Daily Inspection Report. The locomotive may then be operated at normal speed until the next daily inspection or until it reaches the nearest point where repairs can be made, whichever occurs first.

The engineer must:

1. Report any non-complying conditions on the Locomotive Daily Inspection.

2. Leave the completed Locomotive Daily Inspection Report with the non-complying locomotive unless otherwise instructed.

3. Report non-complying conditions to the train dispatcher/ mechanical desk as soon as possible.

4. Notify the relieving engineer of any non-complying conditions when possible.

5. Apply a Non-Complying Tag to the isolation switch on the non-complying locomotive and the controlling locomotive.

Examples of additional non-complying conditions found enroute include:

1. While performing a speed indicator check, an employee determines that the speed is not accurate to within:

   - ±3 MPH at speeds up to 30 MPH.
     or
   - ±5 MPH at speeds above 30 MPH

   See Rule 31.11 (Operative Speed Indicator) when defective speed indicator is found enroute.

2. While moving, crew members detect flat spots. Inspection determines:

   - One or more flat spots are 2-1/2 inches or more in length.

     or

   - Flat spots of 2 inches or more are adjoining.

Note: If a locomotive has flat spots as described above, set it out at the first available point and limit speed to 10 MPH until the setout destination is reached.

31.5 Major Internal Defects Found enroute

If a locomotive enroute has a major internal defect do the following:

1. If possible, isolate the locomotive.
2. Shut down the diesel engine immediately if noise indicates an internal mechanical defect in:

   - Diesel engine.
   - Turbocharger.

     or

   - Components related to the above.

3. If you shut down the engine, do not restart the engine until the equipment has been inspected and can be operated without damaging the locomotive.

4. Report condition to Dispatcher/Mechanical Desk.
5. Fill out an "Out of Service" tag and attach the tag near the engine starting control.

Set out a locomotive with a major defect if the defect requires that the locomotive be set out. Leave the locomotive where maintenance personnel can access it.

31.6 Locomotive Air Brake Test

31.6.1 Location Of Test

Conduct a locomotive air brake test when:

- Making up a locomotive consist.
- Adding locomotive to a consist.
- Other than rear locomotive is removed from consist.
- Locomotive consist is rearranged.

or

- Changing operating ends.

31.6.2 Procedure for Conducting Locomotive Air Brake Test

Ensure locomotive is properly secured.

From the ground, observe that the locomotive brakes apply and release during this procedure:

1. With the independent and automatic brake valve handles in RELEASE, apply the independent brake.
2. After observing that the brakes apply on each locomotive, release the independent brakes.
3. When the brakes are released on all locomotives, apply the automatic brakes by making a 10-psi brake pipe reduction.
4. After the brakes apply on all locomotives, actuate and observe that the brakes release.

5. Reduce brake pipe pressure an additional 10 psi to reapply the brakes.

6. Determine that all brakes apply on all locomotives.

7. Cut out the automatic brake.

8. Observe gauges and verify that equalizing reservoir indicates no leakage and that brake pipe leakage does not exceed 5 psi per minute.

9. Cut in automatic brake and move automatic brake valve handle to RELEASE position.

10. Determine that all brakes release.

31.7 Standard Air Pressures

Ensure that air pressures are as follows:

- Main reservoir pressure is 120 to 140 psi.
- Locomotive brake cylinder pressure is:
  a. Switch locomotives with 10- or 11-inch brake cylinders - 35 psi.
  b. Switch locomotives with 9-inch brake cylinders - 45 psi.
  c. Locomotives with clasp type brake shoe rigging (2 shoes per wheel) -45 psi.
  d. Locomotives with single shoe per wheel brake rigging - 72 psi.

Note: Foreign line locomotives may require different main reservoir and independent brake cylinder pressures.

- Brake pipe pressure is:
  a. Yard or Freight service - 90 psi.
  b. Trains consisting entirely of business car or passenger equipment -105 psi.

Note: Amtrak and Commuter Trains will be governed by their own instructions.

31.8 Reducing Locomotive Overcharge

To reduce locomotive overcharge:

1. Adjust the regulating valve to the desired setting.
2. Make an automatic brake pipe reduction to at least 20 psi below the regulating valve setting.
3. Allow pressure to equalize in the brake system.
4. Move the automatic brake to RELEASE.
5. Verify that the equalizing reservoir pressure is at the required setting.

31.9 Control Switches

Position electrical switches and control equipment in the cab according to instructions on the badge plate or stenciling.

31.10 Locomotive Safety Devices

To the extent possible, make sure these locomotive safety devices are cut in and operating at all times when rules require:

- Overspeed.
- Alerters.
- Deadman controls.
- Automatic cab signals.
- Automatic train stop equipment.
- Automatic train control equipment.

However, safety devices do not have to be operating on non-controlling locomotives, distributed power remote controlling locomotives, or:

1. When a safety device becomes defective enroute.

   or

2. During drag loading/unloading operations under 5 MPH.

If a safety device becomes defective enroute, inform the train dispatcher and mechanical department as soon as possible.

Do not cut out, tamper with, or defeat a safety device without proper authorization or when authorized by rule. When a locomotive is enroute, this authorization may come from the train dispatcher, mechanical supervisor, or other manager.

31.11 Operative Speed Indicator

A locomotive used as a controlling unit at speeds above 20 MPH must be equipped with an operative speed indicator. Follow these speed indicator requirements:

1. Locomotive speed indicators must be accurate within:
   - ±3 MPH at speeds between 10 and 30 MPH.
   - ±5 MPH at speeds above 30 MPH

   Note: Speed indicator that exceeds the above tolerances must be handled as a non-complying condition found enroute.

2. If a speed indicator on a controlling locomotive fails enroute, the locomotive may continue as a controlling locomotive at normal track speed only to the next facility where repairs can be made or until the locomotive is due a daily inspection, whichever occurs first. Movement beyond a facility where repairs can be made or location where daily inspection was conducted must not exceed 20 MPH.

31.11.1 Speed Indicator Test

When leaving the terminal, the engineer must test the speed indicator of the controlling locomotive as follows:

1. Test speed indicator accuracy using identified test miles or mile posts.
2. Conduct the speed check in the 10 to 30 MPH range.
3. Conduct the speed check as near maximum speed as conditions permit.

31.12 Event Recorder

Access to the event recorder is restricted. Only authorized personnel may remove the event recorder data pack or download event recorder data.

31.13 Moving Locomotive

31.13.1 Initial Movement of a Locomotive Consist Not Coupled to Other Equipment

Follow these steps prior to making the initial movement of a locomotive consist outside designated mechanical department limits:

a. Verify that hand brakes are released on all locomotives.

b. Ensure air hoses are coupled between all locomotives in consist including:

- Brake Pipe.
- Main Reservoir.
- Actuation.
- Application and Release.

c. Position cutout cocks and valves for MU operation.

d. Ensure locomotive air brakes are applied on each locomotive during visual inspection.

e. Determine that sufficient main reservoir pressure is present.

Perform these steps during the initial movement of a locomotive consist or as soon as operating conditions permit.

a. At a speed of 1 to 3 MPH, allow the locomotive to drift with the throttle in IDLE.

b. Check that brakes or other defects do not restrict the locomotive's movement.

c. Increase speed to approximately 10 MPH, make a service brake pipe application sufficient to develop brake cylinder pressure.

d. When speed decreases to approximately 5 MPH, actuate to make sure the brakes release.

31.13.2 Initial Movement of a Locomotive Consist Coupled to Other Equipment

When making the initial movement of a locomotive consist that is coupled to a train or other equipment, before speed exceeds 10 MPH, actuate for 5 seconds per locomotive in the consist to determine if brakes apply on trailing locomotive(s) in consist.

If actuating results in brakes applying on trailing locomotives or a sudden change in slack is noted, stop and check MU hose connections. (Lines may be crossed between Act and App/Rel).

If MU hoses are not properly connected, correct the problem and then perform locomotive air brake test 31.6.

31.13.3 Hostling Locomotive

Multiple locomotive consists may be moved within a terminal area with only the brake pipe connected provided speed does not exceed 10 MPH.

Perform the following inspection and test before initial movement of locomotives coupled together and whenever locomotives are added or controlling locomotive is changed:

1. Brake pipe is connected and angle cocks are open between each locomotive.
2. Automatic brake valve must be cutout on all locomotives coupled together except the controlling locomotive.
3. Allow brake pipe to charge.
4. Perform a standing brake test as follows:
   a. Make a 10 psi service brake application.
   b. Ensure brakes are applied on each locomotive.
   c. Release the automatic brake application.
   d. Ensure brakes release on each locomotive
5. Release all hand brakes.

31.13.4 Moving Locomotives Within Mechanical Department Limits

When moving locomotives within mechanical department limits:

1. Charge and properly position brake equipment before moving the controlling locomotive.
2. Apply and release locomotive brakes to verify on controlling locomotive that brake cylinder pistons are operating and brake cylinder lines to trucks are not cut out.
3. Do not move on or off a turntable unless correctly lined and locked.

31.14 Moving Light Locomotive Consists

Operate a light locomotive consist from the cab nearest the direction of travel when any one of the following conditions exists:

- Distance to be traveled exceeds 2 miles.
- A member of the same crew does not control movement using hand signals or radio.

  or

- Visibility is impaired.

31.15 Locomotive Air Brake Equipment

Place air brake valves in the proper position on freight and helper locomotives. Position brake valves and cutout cocks as indicated in the following tables:

26 and 30CDW Brake Equipment Positions			
	Lead	**Trail**	**Helper**
Automatic Brake Valve	Release	Handle Off /Continuous Service	Handle Off /Continuous Service
Independent Brake Valve	Applied Full	Release	Release
Automatic Brake Valve Cutout Valve	Frt/in or Pass	Out	Out
MU-2A Valve or Double-Ported Cutout Cock	**Lead or Dead**	**Trail**	**Lead or Dead**
	In	Out	In

CCB Brake Equipment Positions			
	Lead	**Trail**	**Helper**
Automatic Brake Valve	Release	Handle Off /Continuous Service	Handle Off /Continuous Service
Independent Brake Valve	Applied Full	Release	Release
Air Brake Setup	Lead/Cut in	Trail	Lead/Cut-Out

6BLC Brake Equipment Positions				
		Lead	**Trail**	**Helper**
Automatic Brake Valve		Release	Handle Off /Continuous Service	Handle Off /Continuous Service
Independent Brake Valve		Applied Full	Release	Release
Automatic Brake Valve Cutout Cock	2 Pos.	Open Lead	Closed Trail	Closed Trail
MU-2A Valve or Double-Ported Cutout Cock		Lead or Dead	Trail	Lead or Dead
		In	Out	In

24RL Brake Equipment Positions			
	Lead	Trail	Helper
Automatic Brake Valve	Release	Release	Lap
Independent Brake Valve	Applied Full	Release	Release
Automatic Brake Valve Cutout Valve	Open	Closed	Closed
Rotair Valve	Pass or Frt	Frt Lap	Pass or Frt
MU-2A Valve	Lead or Dead	Trail	Lead or Dead

31.16 Separating Locomotives

When separating locomotives do the following:

1. Apply hand brakes on locomotives to be cut away from.
2. Disconnect electric jumper cables.
3. Plug the jumper cables into a dummy receptacle.
4. Close cutout cocks.
5. Disconnect walkway safety chains.
6. Disconnect fuel tender hoses (if equipped).
7. Separate locomotives.
8. Attach air hoses to the dummy couplings or place them in the pockets.

31.17 Locomotives Equipped for Multiple-Unit Operation

31.17.1 Locomotives With Alignment Control Couplers

When a locomotive equipped with alignment control couplers is being placed in a train with the diesel engine isolated or shutdown, couple the locomotive(s) directly behind the locomotive consist at the head end of the train. Then, do the following:

1. Set up air brake equipment as a trailing unit, couple all hoses, connect MU jumper cables and open all cut out

cocks between the operating locomotive consist and the units that will be moved.

2. Perform an air brake test as outlined in Rule 30.3.3. (Procedure for Inspection and Test of Locomotive Brakes.)

Exception: SW and MP model switch engines must be placed second in the locomotive consist, one per train, when handling cars.

If it cannot be determined whether a locomotive is equipped with an alignment control coupler, locomotive must be moved as described in 31.17.2 below.

31.17.2 Locomotives Not Equipped with Alignment Control Couplers

Most SW1200, SW1500, MP15, GP7, GP9, SD7 and SD9 locomotives waybilled locomotives, some foreign line road and switch engines and some Amtrak and other commuter locomotives are not equipped with alignment control couplers. These units may be identified on the train list. They are to be placed second in the locomotive consist, one per train when handling cars.

Mechanical inspection forces must ensure that coupler swing limiting devices are in place before these units move in freight trains. Coupler swing limiting devices do not make the coupler an alignment control coupler.

31.18 Locomotives Not Equipped for Multiple-Unit Operation

31.18.1 Locomotives Equipped with Alignment Control Couplers

Shut down locomotives that are not equipped for multiple-unit operation or have inoperative multiple-unit equipment and couple them directly behind the locomotive consist.

Waybilled locomotives and locomotives that cannot be determined whether equipped with an alignment control coupler, must be move as described in 31.18.2

31.18.2 Locomotives Not Equipped with Alignment Control Couplers

Locomotives that are not equipped with alignment control couplers may be identified on the train list. They must be shut down and placed not less than five cars or greater than ten cars from the rear of the train, with at least one car separating locomotives. No more than two locomotives may be placed in a train.
Mechanical inspection forces must ensure that coupler swing limiting devices or truck bolster movement limiting devices are in place before these units are moved in freight trains. Distributed power consists or manned helpers must be cut in ahead of locomotives not equipped with alignment control couplers.

Place locomotive with bolted or temporary drawbars no more than five cars from rear of train.

31.18.3 Set-up Procedure for Handling Locomotives Not Equipped for Multiple-Unit Operation

Complete the following:

1. Make sure the dead-engine feature cutout cock is open or "Dead."
2. Cut out the automatic brake valve and place the handle in the HANDLE OFF/CONTINUOUS SERVICE position.
3. Cut in the independent brake valve and place the handle in the RELEASE position.
4. Close the cutout cocks in the main reservoir equalizing pipe.
5. Make sure the cutout cocks in the actuating pipe and independent application and release pipe are open.

31.19 Changing Operating Ends

Change operating ends on a locomotive consist by cutting out the operating controls on the controlling end of the locomotive consist and proceeding immediately to the opposite end of the locomotive consist and restoring control.

31.19.1 Cut Out Operating Controls

To cut out operating controls, do the following:
1. Apply sufficient hand brakes to hold locomotive consist.

2. Place the throttle in IDLE.
3. Place the reverse lever in NEUTRAL and remove the handle.
4. Fully apply the independent brake.
5. Cut out the independent brake.
6. Place the independent brake valve handle in RELEASE.
7. Make a 20-psi brake pipe reduction.
8. Cut out the automatic brake.
9. Place the automatic brake valve handle in HANDLE OFF/CONTINUOUS SERVICE.
10. Place the generator field switch in the OFF position.
11. Disarm 2-way EOT, if equipped.

31.19.2 Restore Operating Controls

To restore operating controls, position equipment on the control stand as follows:

1. Replace the reverse lever.
2. Place the independent brake valve handle in FULL APPLICATION.
3. Cut in the independent brake.
4. Place the automatic brake valve handle in RELEASE.
5. Cut in the automatic brake.
6. Place the generator field switch in the ON position.
7. Place the engine run switch in the ON position.
8. Place the control/fuel pump switch in the ON position.
9. Conduct the test as specified in Rule 31.6 (Locomotive Air Brake Test).

31.20 Changing to Opposite Controls in the Same Cab on Dual Control Locomotives

Follow this procedure to change to opposite controls in the same cab:

31.20.1 Controlling Brake Valve

1. Move the independent brake handle to FULL APPLICATION.
2. Make a 20-psi brake pipe reduction.
3. Return the automatic brake handle to LAP and remove the brake handle.
4. Move the independent brake handle to RELEASE.
5. Move to the opposite set of air brake controls.

31.20.2 New Controlling Brake Valve (Opposite Side of Locomotive)

1. Remove the automatic brake handle with the stop plate attached and place it on the non-controlling automatic brake valve in LAP.
2. Insert the automatic and independent brake handles.
3. Move the independent brake handle to FULL APPLICATION.
4. Move the automatic brake handle to RELEASE.
5. Check the air gauges and verify that the proper pressures are being maintained.
6. Conduct the test specified in Rule 31.6 (Locomotive Air Brake Test.)

32.0 Train Operations

32.1 Securing Equipment Against Undesired Movement

Crew members are responsible for securing standing equipment with hand brakes to prevent undesired movement. The air brake system must not be depended upon to prevent an undesired movement.

When leaving cars unattended use the following steps to determine the number of hand brakes to be applied:

- On a descending grade with slack bunched, apply the hand brakes on the low end of the cut of cars. To verify the hand brake(s) applied will prevent movement, release all air brakes. (See guideline below when unable to verify sufficient hand brakes applied).

- On an ascending grade with slack stretched, apply the hand brakes on the high end of the cut of cars. To verify the hand brake(s) applied will prevent movement, release all air brakes. (See guideline below when unable to verify sufficient hand brakes applied).

- At other locations where the crew has determined that equipment will not move with all brakes released, after slack is adjusted, apply enough hand brakes to hold the equipment. Sufficient hand brakes must be applied to prevent undesired movement of equipment from outside forces or when coupled to by other equipment.

Note: Retaining valves on the cars to be left must be in the EXHAUST position.

The number of hand brakes to be applied depends on:

- Grade.

- Number of loaded and empty cars, and type of car.

Note: Solid drawbar articulated cars and heavy duty flatcar, 8 axles or more, and most 5-unit articulated intermodal cars have two or more hand brakes. When applying hand brakes on one of these cars, all of the hand brakes must be applied. Most of the intermodal cars having two hand brakes have the hand brake painted orange and/or are stenciled "SECOND HAND BRAKE AT OPPOSITE END".

- Weather conditions (wind and temperature).

The following guideline is for the minimum number of hand brakes required if unable to verify that sufficient hand brakes have been applied by release of the air brakes (*i.e.* only rear of train being left unattended). Additional special instructions may be in effect on some subdivisions.

Guideline Chart When Unable to Verify Required Hand Brakes by Release of Air Brakes													
Number of Applied Hand Brakes Required													
	Grade (%)												
Tons	0	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00+
<1000	2	2	2	2	3	3	4	4	5	6	7	7	9
1000+	2	3	3	3	5	6	8	8	10	12	13	14	15
2000+	2	3	5	5	6	8	9	11	12	14	15	17	20
3000+	3	5	5	7	8	10	12	14	16	18	20	23	30
4000+	4	5	5	8	10	13	15	18	20	23	25	28	35
5000+	5	6	7	9	12	15	18	21	24	27	30	33	39
6000+	5	7	8	11	14	18	21	25	28	32	35	39	46
7000+	5	6	12	17	23	29	34	40	45	51	57	62	79
8000+	5	8	10	14	18	23	27	32	36	41	45	50	60
9000+	5	9	12	15	20	25	30	35	40	45	50	55	65
10000+	6	10	13	17	22	28	33	39	44	50	55	60	100%
11000+	6	11	15	18	24	30	36	42	48	54	60	66	100%
12000+	7	14	16	20	26	33	39	46	52	59	65	72	100%
13000+	8	15	17	22	28	35	42	49	56	63	70	100%	100%
14000+	8	15	20	23	30	38	45	53	60	68	75	100%	100%
15000+	9	16	22	24	32	40	48	56	64	72	80	100%	100%
16000+	10	18	24	26	34	43	51	60	68	77	85	100%	100%
17000+	10	20	26	28	36	45	54	63	72	81	90	100%	100%

Terminal Areas:

Terminals, classification bowl tracks, car and locomotive facility service and repair tracks may have their own minimum number of hand brakes to be applied at each location.

32.1.1 Securing an Unattended Train or Portion of Train with Locomotive Attached

To secure a train or a portion of a train with the lead locomotive consist attached, perform the steps below:

1. Secure equipment against undesired movement as outlined in Rule 32.1 (Securing Equipment Against Undesired Movement).

2. Secure the lead locomotive consist and apply the air brakes as outlined in Rule 32.1.3 (Unattended Locomotives).

32.1.2 Securing an Unattended Train Before Detaching Locomotives

When any part of a train is left standing do not depend on the air brake system to secure the cars.

When detaching locomotives or locomotives and cars:

1. Secure equipment against undesired movement as outlined in Rule 32.1 (Securing Equipment Against Undesired Movement).

2. Release air brakes to ensure hand brakes will prevent movement.

3. Make a 20-psi brake pipe reduction.

4. Close angle cock on rear locomotive or last car to be detached from portion left standing. Leave angle cock open on portion left standing.

5. Allow brakes on any standing portion to apply in emergency. When available, use the end-of-train telemetry device to make sure that brake pipe pressure drops to 0 psi.

6. Do not bottle air or maintain air pressure in the brake pipe when locomotives are detached or yard air is uncoupled. However, if cars will not be left unattended and the locomotive will immediately couple to the cars at the opposite end; after the brake pipe pressure has completely exhausted, wait 1 minute, then the angle cock on the standing portion of the train may be closed to allow a locomotive to switch the cars from the opposite end.

   Exception: When separating a train in temperatures below 25 degrees F and the train is on a light grade, (see Glossary) follow the steps in Rule 30.17 (Inbound Train Inspection) to prevent vent valves from sticking open.

32.1.3 Unattended Locomotive(s)

When securing locomotives:

1. Place the throttle in IDLE unless you are protecting the engine from freezing.
2. Place the transition handle (if equipped) in the OFF position.
3. Place the generator field switch or the circuit breaker on the control stand (if equipped) in the OFF position.
4. Remove the reverser handle from the reverser slot on the control stand and place it in the receptacle, if equipped. Do not remove the reverser handle if you need to increase the throttle position to prevent freezing.
5. On locomotives coupled to other equipment, apply hand brakes on all locomotives. Release air brakes to determine hand brakes will prevent movement. However, hand brakes on remote control locomotives are not required when equipment remote control locomotive is coupled to is properly secured.
6. Make a 20-psi brake pipe reduction after allowing the brake system to charge.
7. Leave the automatic brake valve cut in.
8. Fully apply the independent brake.
9. Place engine control switch to ISOLATE on all locomotives.

Additional securement guidelines for unattended locomotives not coupled to other equipment:

10. Must not be left unattended on a main track.
11. When left unattended on auxiliary tracks must be protected by derail(s) or a facing point switch lined and locked to prevent movement to the main track.
12. Must have all hand brakes applied. Release locomotive brakes to determine hand brakes will prevent movement.

Exception: Distributed power remote locomotives, when on unattended trains, do not require hand brakes to be applied or engine control switch to be placed in ISOLATE when train is otherwise properly secured. Distributed power remote consists may be left standing with all hand brakes applied at any location, even on the main track, when in the process of making up a DP train. At mechanical facilities, when locomotives are protected by outbound derails on designated servicing tracks, apply a sufficient number of hand brakes to prevent undesired movement, but a minimum of one per locomotive consist.

32.1.4 Train Break-in-Two

A. Brake Application

If brakes are applied in emergency because of a train break-in-two:

1. Immediately apply hand brakes to the extent needed on the detached portion at the point of separation to prevent it from rolling away while the following steps are completed. Refer to Guideline Chart in Rule 32.1.
2. Apply hand brakes to the extent needed on the low end of both portions of the train.
3. Close the angle cock on the front portion of the separation.
4. Recharge the air brake system immediately.

EXCEPTION: If necessary to replace the knuckle or perform any work under or between the separated portions of the train, leave the angle cock on both portions of the train open while the work is being performed.

32.2 Releasing Hand Brakes

Before moving cars or locomotives, fully release all hand brakes to prevent wheel damage.

If a hand brake is difficult to release, charge the air brake system and make a full service application of the car or locomotive brakes before attempting to release the hand brake again. If hand brake is still difficult to release place the car or locomotive brake system into emergency.

If the hand brake cannot be released using the above method do not move the car except to set it out. Car must be watched during entire movement to set out and limit speed to 5 MPH if wheels are not turning freely. Report defect to Mechanical Desk/Dispatcher.

When releasing hand brakes, check at least three additional cars beyond the last applied hand brake to ensure that no other hand brakes are applied.

32.3 Transferring Control of Train Brakes from One Locomotive to Another

Transfer control of the brakes as follows:

Original controlling locomotive

- With brakes applied, before detaching original controlling locomotive, close both angle cocks between the locomotives, or the cars being separated, if new controlling locomotive is attached other than at the same location in the train.

New controlling locomotive

1. Cut in independent brakes on new controlling locomotive and apply the independent brake fully, Rule 32.3 Transferring Control of Train Brakes from One Locomotive to Another..
2. Move the automatic brake valve handle to the RELEASE position to recover the equalizing reservoir pressure
3. Move the automatic brake valve handle into the service zone until the equalizing reservoir pressure is slightly below brake pipe pressure.
4. Place the brake valve cut off valve in the FRT position.
5. Immediately reduce brake pipe pressure to a full service reduction.

When the original lead locomotive is reattached to the train, control of the air brakes must be transferred to the lead locomotive as follows:

On locomotive left standing with train

1. Cut out the automatic and independent brake valves of the locomotive on train left standing.

On locomotive to assume control of the train

1. Apply independent brake fully
2. Cut out automatic brake valve.
3. Open angle cock between locomotive and train left standing.
4. Move the automatic brake valve handle into service zone until the equalizing reservoir pressure is slightly below brake pipe pressure.
5. Cut in automatic brake valve.
6. When ready to release brakes, place automatic brake valve in RELEASE position and recharge train. Before proceeding, determine the indication of release at the rear of the train.

32.4 Brakes Not Operating Properly

If the train brakes are not operating properly, stop the train immediately and:

1. Inspect the brakes to identify and correct the problem.
2. Before proceeding, conduct an application and release test as specified in Rule 30.15 (Application and Release Test, Class 3).
3. Once the train is proceeding, conduct a running test as specified in Rule 32.15.1 (Procedure for Running Air Brake Test).

32.5 Sticking Brakes

Sticking brakes occur when brakes on a car(s) remain applied after a train brake release. When brakes stick:

1. Stop the train as soon as possible.
2. Determine why the brakes are sticking. Some reasons for sticking brakes include:
   - Overcharged air brake system.
   - Hand brakes applied.
   - Retaining valve not in EXHAUST.
   - Leak in the air brake system.
   - Releasing a brake pipe reduction with brake pipe air still exhausting.
   - An insufficient brake pipe reduction to ensure proper release.
3. Correct the problem.
4. If necessary, cut out the control valve or set out the car.

32.5.1 Minimizing Sticking Brakes

To minimize the possibility of sticking brakes, observe the following:

1. Do not overcharge the train air brake system.
2. When handling cars to be placed on the rear portion of a freight train, regulating valve pressure setting must be 10 psi less than standard pressure for that train.
3. When a running release of train brakes is to be made, if operating conditions permit, increase the brake pipe reduction to at least 10 psi and allow brake pipe exhaust to stop for at least 20 seconds before releasing.
4. When the train air brakes are used to stop a train, when operating conditions permit, increase brake pipe reduction to at least 10 psi after stopping. The brakes must not be released until at least 20 seconds after exhaust stops.

32.6 Reducing Pressure in Overcharged Train Brake Systems

To reduce pressure in an overcharged train brake systems do the following:

1. Adjust the regulating valve to the desired pressure.
2. Make a full service brake pipe reduction with the automatic brake.
3. Wait at least 30 seconds after the brake pipe exhaust stops. Move the automatic brake handle to RELEASE and charge the system to the required pressure.

Note: If train is stopped an emergency application may be made.

32.7 Cutting Out Air Brake Equipment

Cut out control valves or other air brake devices only if they are defective or if the brake rigging is being serviced. If air brake devices must be cut out en route, notify the train dispatcher and the Mechanical Help Desk of car number(s) and any other pertinent information. Also refer to Rule 30.4 for additional requirements.

32.7.1 Procedure to Cut Out Control Valve or Automatic Vent Valve

Cut out control valves or automatic vent valve as follows:

1. Close the branch pipe cutout cock.
2. When cutting out a control valve, drain the air reservoirs completely by operating the brake cylinder release valve.

32.7.2 Placement of Cars with Cut-Out Air Brake Equipment

Follow these requirements when multiple air brake devices must be cut out:

1. Make sure no more than two air brake devices that have been cut out are together in a train.
2. If necessary to cut out a third consecutive air brake device, separate it from the other two cars with cutout brakes by at least one car with operative brakes.

3. If one air brake device/control valve is cut out on a car with multiple control valves, consider the brakes on that car to be operative.

32.7.3 Rear Car Brakes

The rear car of a train must have operative air brakes. However, the rear car brakes possibly could become inoperative en route. When this happens, follow these steps:

1. Before moving the train, test the hand brake on the disabled car.

2. If the hand brake is inoperative, do not move the car until it is repaired and can be moved safely.

3. Chain, strap or cable the disabled rear car to the rear of the train.

4. Move the car directly to the first auxiliary track and switch it ahead of at least one car with operative brakes, or set it out.

Note: Even though the disabled car has inoperative brakes, the air must be cut in to the brake pipe. If the brake pipe on disabled car is broken, car with a broken brake pipe should be handled with brake pipe pressure in air hoses between car ahead and disabled car. With air hoses coupled between rear car and car ahead, cut the air in between the rear car and the closed angle cock on the disabled car. (This is in order to ensure an emergency application of the train's air brakes should the disabled car become separated from the train.)

32.7.4 Bleed Off Cars

Bleed off cars only when:

- Repairing the brake system.
- Cutting out the brakes on a defective car.

or

- Switching.

32.8 Reporting Flat Spots

While inspecting car and locomotive wheels, measure and report flat wheels to the train dispatcher and Mechanical Help Desk so they can be repaired.

1. Determine the length of the flat area.
2. If the length of the flat area is more than 1 inch, report it.
3. In cases of a flat wheel(s) on a switch locomotive, inform:
   - Maintenance facility.
   - Yardmaster.
   - Supervisor.
4. For speed restriction, see GCOR Rule 1.34.

Note: Adjoining, as referenced in GCOR 1.34, means flat spots less than 1 ½ inches apart.

32.9 Setting Out Defective Cars

Set out a defective car whenever it cannot be safely moved to the next repair location. When defective car must be set out, do the following:

1. Report this fact to the train dispatcher and mechanical desk.
2. Set out defective car where maintenance crews can access it.
3. If the journal is overheated, inspect the underside of the car immediately if the maintenance crew is not available.
4. Include location of overheated journal with tag.
5. When a derailed car with roller bearings is re-railed by other than Mechanical Department employees, move it carefully to a setout point for inspection and maintenance.

32.10 Coupling Brake Pipe Connections

Maintain brake pipe connections to enable the air brake system to function properly throughout the train.

Angle cocks must never be left partially closed or partially open.

Before coupling air hoses to charge brake pipe:

1. Make a 20-psi brake pipe reduction. If necessary to prevent an undesired release of the cars being coupled to, make a 40-psi brake pipe reduction.

2. Signal that the brake valve exhaust has stopped by sounding whistle signal 5.8.2, (2), or using the radio.

3. Open angle cocks slowly to prevent an emergency brake application.

Note: Distributed power trains, in some cases, require a different procedure when coupling to rear portion of train. Refer to instructions for DP.

4. When adjusting air hose height:

   - Couple the air hoses.

   - Verify that the brake pipe hose support is adjusted so that the glad hands are at least 4 inches above the top of the rail.

32.11 Powered Axle Limitation

Locomotive lead consist must not have in excess of **50** equivalent powered axles. Excess axles of power must be isolated. Unless otherwise restricted, trains made up entirely of intermodal equipment may operate with a maximum of **60** equivalent powered axles.

32.12 Helpers

32.12.1 Manned Helper Entrained or Coupled at Rear of Train

1. When a manned helper is entrained or coupled at the rear of the train, before the angle cocks are opened the engineer on the manned helper must:

   a. Make a 20 psi brake pipe reduction.

   b. Cut out the automatic brake valve and place the handle in the HANDLE OFF/CONTINUOUS SERVICE position.

c. Place the independent brake valve handle in the RELEASE position, and leave the independent brake valve cut in.

d. Couple the brake pipe hoses. Open the brake pipe angle cock on the locomotive first, then slowly open the brake pipe angle cock on the car.

2. After the manned helper is placed in the train or coupled at the rear of the train, the engineer of the leading locomotive must:

a. Increase brake pipe reduction to 20 psi. (if necessary to observe 5 psi reduction, release and recharge).

b. Observe at least a 5 psi brake pipe reduction at the rear of the train as indicated by a gauge or device.

c. Helper crew will visually inspect brakes on helper consist to ensure application.

d. After obtaining the desired reduction, release the train brakes and determine there is at least a 5 psi brake pipe increase at the rear of the train as indicated by a gauge or device.

32.12.2 Removing an Entrained Helper

After an entrained helper has been removed conduct a brake test as specified in Rule 30.15 (Application and Release Test)

Note: This air brake test is not required when removing manned helpers from the rear of the train.

32.12.3 Manned Helper Added to Head End of Train

When a manned helper is coupled on the head end of the train, transfer control of air brakes (and throttle with MU cable) to the manned helper as follows:

1. Before opening angle cocks between the road locomotive and the manned helper, the engineer on the road locomotive will:

a. Make at least a 6 psi brake pipe reduction.

b. After brake pipe exhaust has ceased, cut out the automatic brake valve and place handle in the Handle Off/Continuous Service position.

c. Notify the engineer on the manned helper of the amount of brake pipe pressure reduction made.

d. Independent brake valve must be left cut in.

2. The engineer on manned helper will:

a. Move the automatic brake valve handle into the service zone to reduce the equalizing reservoir pressure at least 2 psi below the brake pipe pressure reduction made by the engineer on the road locomotive.

b. After opening the angle cock, increase brake pipe reduction to at least 20 psi and observe at least a 5 psi reduction at the rear of the train as indicated by a gauge or device.

c. Release the automatic air brakes and observe that brake pipe pressure is being restored at the rear of the train by observing a 5 psi increase in pressure as indicated by gauge or device.

32.12.4 Manned Helper Removed From Head End of Train

When a manned helper will be detached from the head end of train do the following:

- Engineer on manned helper will:

a. Make not less than a 6 psi brake pipe reduction.

b. Notify the road engineer of the amount of brake pipe reduction made.

- Detach manned helper.

- Road engineer will:

a. Move the automatic brake valve into the service zone to reduce the equalizing reservoir pressure at least 2 psi below the brake pipe pressure reduction made by the helper locomotive engineer before cutting in the automatic brake valve.

b. Increase brake pipe reduction to 20 psi and observe at least a 5 psi reduction at the rear of the train as indicated by a gauge or device.

c. Release the automatic air brakes and observe that brake pipe pressure is being restored at the rear of the train by observing a 5 psi increase in pressure as indicated by gauge or device.

32.12.5 Operating Responsibilities with Manned Helper

Comply with these manned helper operating responsibilities:

- When adding helpers to other locomotives on a train, control of all locomotives coupled together must be transferred to the lead engineer by plugging in the MU cable, whenever practicable.
- When more than one locomotive is attached to a train, the engineer in the lead locomotive must control the train's air brakes.
- The engineer in the lead locomotive is in charge of train movement.
- The engineer in charge will communicate with and direct the helper locomotive engineer as follows:
  a. Identify speed restrictions and locations where a stop is to be made at least 2 miles in advance.
  b. Communicate clearly the name or aspect of signals affecting the helper locomotive's movement as soon as the signals become visible or audible.
- When dynamic braking is used on both lead and helper locomotives:
  a. The helper engineer should maintain constant dynamic braking force at the direction of the lead engineer.
  b. The lead engineer should control variations in train speed.
- Do not cut off helper locomotive while the train is moving. (unless equipped with "Helperlink".)
- Locomotives using "Helperlink" must not plug in MU cable if coupling to other locomotives.

32.12.6 Distributed Power

A. Employee Familiarization

The following rules are specific to helper service by means of Distributed Power operations. In addition, employees who set up or operate Distributed Power equipment must be familiar with the requirements and instructions for the type of system they will operate. Due to the various versions of DP technology, these instructions are contained in the Distributed Power Guide for System Locomotives developed by the railroad company.

B. Preparing Locomotives for Distributed Power Service

Locomotives that are radio linked on the service track for pre-testing must be unlinked prior to being placed in the train. Locomotives must be radio linked after they are placed in the train.

C. Brake Pipe Continuity Test Following Radio Link

Before making a brake pipe continuity test immediately following radio link, the air flow rate on each DP controlling locomotive in the train:

- Must not exceed 20 CFM.

  or

- Becomes stabilized after charging. If the air flow rate does not reduce to 20 CFM and if there is no further decrease in flow rate for a period of at least 90 seconds then the flow rate is considered to be stabilized.

Brake Pipe Continuity and Leakage Test Required

A Brake Pipe Continuity and Leakage Test will be required when a Distributed Power train:

- Is originally made up.
- Increases its total length (including locomotive power) to greater than 7,500 feet. This will require unlinking the remote(s) and re-linking in order to run these Distributed Power test functions.

D. Radio Communication Interruption

When radio communication is interrupted, the last throttle command and brake pipe pressure being maintained by the Distributed Power remote(s) remain in effect for up to 90 minutes.

Idling Remote During Communication Interruption

To signal the affected remotes to return to idle and place them in the isolate mode, the engineer must make a 10 pound brake pipe reduction or increase the brake pipe reduction by 10 pounds (if brakes are already applied before the communication interruption occurred).

WARNING: If the brake system is not fully charged at the time of a communication interruption, make a brake pipe reduction sufficient to reduce brake pipe pressure at least 5 pounds below the last brake pipe reduction.

Operation During Loss of Communication

During a communications interruption between the lead and remote(s), keep the train moving, if possible, to a location where communications might improve.

E. Conditions Which Require Actions to Protect a Single Remote Locomotive

If remote locomotive is:

- Dead and Linked: Set up unit in Dead in Train (DIT) configuration until locomotive can be set out or moved to head-end of train.
- Running and Unlinked: Set out locomotive or move to head-end of train.
- Dead and Unlinked: Set out locomotive or move to head-end of train.

F. Changing from Independent Mode to Synchronous Mode

When operating Distributed Power train consists in the independent mode, do not place locomotive consists in synchronous mode until all consists are in the same throttle setting, consistent with good train handling.

32.12.7 Helper Placement

A. Rear or Cut-in Requirement for Helper

Use the following applicable table to determine whether a helper is placed on rear of train or at cut-in position on train.

Helper Restrictions, Any Train	
Any helper	Must be placed ahead of: 1. Rail pick-up cars RGAX 4694-4696; 2. Two-axle scale test car; 3. Car designated 'Rear End Only' or 'Rear Rider'; 4. Occupied caboose; 5. Single platform two-axle car in series TTOX; 6. Solid drawbar-connected three platform cars in series FEC 60000-60199. 7. Solid drawbar-connected five platform cars in series CN 677000-677139. 8. Solid-drawbar gondola AMGX cars with symbol 2-P.

Loaded Bulk Commodity Unit Train	
HELPER EPA	**Placement Requirement**
28 or less	**May** be placed on rear or cut-in as outlined in Part B below.
29 to 55	**Must** be cut-in as outlined in Part B below.

Empty Bulk Commodity Unit Train	
HELPER EPA	**Placement Requirement**
16 or less	**May** be placed on rear or cut-in as outlined in Part B below.
17 to 32	**Must** be cut-in as outlined in Part B below.

Other Than a Loaded or Empty Bulk Commodity Unit Train	
HELPER EPA	Placement Requirement
7 or less	May be on the rear.
8 to 16	**Restriction A:** Placed on rear. The following makeup restrictions apply to cars and/or the platform/wells of multi-platform cars entrained within the **250** restricted tonnage limit immediately ahead of the helper. 1. A non-articulated multi-platform car having a single empty platform. 2. An articulated multi-platform with two consecutive empty wells. 3. Car 45 feet or less in length coupled to a car 80 feet or longer in length weighing less than 60 tons. Note: Item 3 does not apply to multi-platform spine cars or multi-platform double stack cars. 4. An intermodal flatcar 85 foot or greater loaded with a single trailer/container. **Note:** This also applies to two unit, solid drawbar-connected, twin flatcars (186 ft in total length) with a single trailer/container on either platform. Helper may be cut-in to a location that will permit complying with the above requirement. Part B below will not apply.
17 to 23	**Restriction B:** Placed on rear. A non-articulated multi-platform car having a single empty platform. 1. An articulated multi-platform with two consecutive empty wells. 2. Car 45 feet or less in length coupled to a car 80 feet or longer in length (excluding multi-platform spine cars or a multi-platform doublestack cars) weighing less than 60 tons. 3. An intermodal flatcar 85 foot or greater loaded with a single trailer/container. Note: This also applies to two unit, solid drawbar-connected, twin flatcars (186 ft in total length) with a single trailer/container on either platform. 4. No car weighing less than 45 tons. Helper may be cut-in to a location that will permit complying with the above requirement. Part B below will not apply.
24 to 36	**Restriction C:** Must be cut-in as outlined in Part B below. Make up restriction same as Restriction B above.

If rear helper or cut-in helper exceeds EPA requirements in above tables, sufficient locomotives must be isolated to prevent exceeding EPA limits in tables.

It is permissible to cut out traction motors or trucks on units equipped with locked axle protection (GE AC, GE C40-8, GE C44-9 and EMD AC locomotives) in order to comply with the above axle limitations.

B. Tonnage Placement for Cut-in Helper

When the following tonnage placement requirement conflicts with makeup restrictions in the "Other Than a Loaded or Empty Bulk Commodity Unit Train" table, a cut-in helper may be moved up to five cars or platform/wells ahead or behind the calculated position to comply with this Part.

Position Requirements for one cut-in Helper.

To determine the placement of one helper, divide the total tonnage of the train by the EPA of both the helper and the lead consists. Multiply that number by ½ the EPA of the helper. This number is the tonnage to be placed behind the helper

$$\frac{\text{(Tonnage of train)}}{\text{(Total EPA of Helper and lead consists)}} \times \text{(½ EPA of Helper)} = \text{(Tonnage to be placed behind Helper)}$$

Example: 115-0-16445 tons
Lead Consist: 2 C44AC - (24 EPA)
Helper: 2 C44AC - (24 EPA)
Total 48 EPA

$$\frac{16445 \text{ tons}}{48} \times (12) = 4111 \text{ (Tonnage to be placed behind helper)}$$

Position Requirements for Cut-in Helper with Additional Helper on Rear.

To determine the placement of a cut-in helper when the train also has a helper on the rear, divide the tonnage of the train by the combined total of the EPA of the rear helper, the cut-in helper and the lead consist. Multiply this number by the combined total of the EPA of the rear helper and ½ the EPA

of the cut-in helper. This number is the amount of tonnage to be placed behind the cut-in helper.

$$\frac{\text{(Tonnage of train)}}{\text{(Total EPA of all consists)}} \times \text{(EPA of rear helper + ½ EPA of cut-in helper)}$$

Example: 115-0-16445 tons

Lead Consist:	2 C44AC (24 EPA)
Middle Helper:	3 C44AC (36 EPA)
Rear Helper:	1 C44AC (12 EPA)
Total	72 (EPA)

$$\frac{16445 \text{ tons}}{72} \times (12+18) = 6852 \text{ (Tonnage to be placed behind cut-in helper)}$$

32.13 End of Train Telemetry System

32.13.1 Installation

Only an end of train device (EOT) calibrated within the last 365 days and an EOT battery that has been tested within the last 60 days may be used. Refer to the affixed stickers prior to installation.

1. To determine a battery-operated EOT is charged sufficiently at installation point, depress the test button on the EOT. Several messages will be displayed including the percentage of battery life that has been used, displayed as "C XX". At installation point, do not use an EOT battery if battery life used is indicated as greater than 10.

Note: All EOT battery requirements do not apply to an ATX EOT (Air–Turbine operated EOT's. Generator voltage is displayed on the HEU for an ATX EOT in lieu of battery charged units)

2. After entering the EOT number on the head end unit (HEU) of the locomotive, push the COMM TEST button to establish one-way communication with the EOT.

32.13.2 Arming HEU/EOT

Two people are needed to arm the HEU.

To arm the HEU:

1. Press the TEST button on the EOT, which will display the ARM NOW message on the message display window of the HEU.

2. Immediately press the COMMUNICATIONS TEST/ARM button on the HEU, which will display the ARMD message on the message display window of the HEU and light the EMERG ENABLED status LED at the same time.

If NOT ARMD appears on the HEU message display, the system did not accept the arming sequence, repeat steps above. Some foreign HEU / EOT systems are self-arming when telemetry is established and may be so indicated by a "*" displayed on the HEU.

The system is now armed.

32.13.3 Testing HEU/EOT

To test the emergency application capability from the rear of the train, do the following:

1. Close the angle cock between the train and EOT.

2. Initiate an EOT emergency from the lead locomotive HEU. The brake pipe pressure on the EOT must reduce to 0 psi.

3. Open the angle cock between the EOT and train and determine that brake pipe pressure is restored before proceeding.

Exception: When using an ATX EOT, air pressure trapped in the air hoses while performing the above emergency test is depleted quickly by the air turbine. Therefore, for additional volume, the emergency valve function test must be performed after closing the angle cock ahead of the last car. A successful ATX EOT emergency function test can be determined by listening for the last car's emergency application.

Note: When performing EOT emergency test, allow EOT emergency valve to automatically close before opening angle cock. EOT emergency valve will require a minimum of 15 seconds to reset after actuated. No attempt to restore brake pipe pressure should be made until emergency brake valve on EOT has reset. Failure to wait

a minimum of 15 seconds after testing valve before again opening brake pipe to valve may result in an erroneous "Valve Fail" indication.

A. Establishing Communications

If the End of Train Telemetry System is unable to establish communications at the installation point, train may be moved a maximum of one mile at restricted speed in an attempt to establish communications, arm and test an EOT.

B. Engineer Notification

When the test of the emergency application capability from the rear is conducted the engineer must be notified verbally or in writing that the test was successfully performed. If verbal notification is made, train crew must record this notification on prescribed form.

The written notification must include the following:

- Date and Time of test.
- Location of test.
- Name of employee conducting test.

Written notification must be maintained in the cab of the controlling locomotive.

32.13.4 Disarming HEU/EOT

Disarming the HEU disables the emergency command for all EOT ID numbers.

To disarm the HEU:

1. Set the HEU ID code to 00000 (or follow the disarm procedures on electronic display.)
2. Press the COMMUNICATIONS TEST/ARM button.
3. Verify that:
   a. The HEU displays DISARMD in the message display window.
   b. The EMERG ENABLED status LED turns off.

c. The EMERG DISABLED LED turns on.

4. When a two-way EOT armed to a HEU are to be separated such as when reaching the train's final terminal or when changing either an EOT or HEU en route, the HEU must be disarmed as outlined above.

GE locomotives with screens displaying "Armed Other" indicate the HEU was not disarmed from the last 2-way EOT utilized. This condition can be corrected by either of two methods:

- Enter the EOT number of the last EOT and disarm as prompted by the EOT screen display before then establishing telemetry with another EOT;

  or

- If last EOT identifying number is not known, HEU may be disarmed by entering a valid new EOT number, establishing communication and arming as outlined in Rule 32.13 above. When test button is pushed on new EOT, depress button below "Arm Now" prompt that will briefly appear in the lower right corner of the EOT screen.

32.13.5 Emergency Switch

Once a system is properly armed, an emergency brake application can be made at any time. To initiate an emergency brake application at the end of the train:

1. Lift the red cover of the EMERGENCY SWITCH located on the right side of the HEU.

2. Push the toggle switch up.

3. Verify that:

   a. The message EMERGENCY briefly appears in the message display window.

   b. The brake pipe pressure reading quickly drops to 0 psi.

   c. The LOW PRES message is displayed while the last car pressure is below 45 psi.

Note: Immediately following a release of a service brake application, if the two-way end-of-train device is activated, an emergency application MAY NOT occur from the

device. However, the brakes will apply on the rear end of the train at a service rate. If this condition occurs, it will only be during initial stages of the release (approximately 4-10 seconds). This will not affect emergency brake capabilities from the head end of the train.

32.14 Emergency Application Capability from Rear of Train

A. Requirements

All trains must be operated with a method of providing emergency application capability of the brakes from the rear of the train.

However the following trains are exempt from the requirement of this rule:

- Amtrak and Commuter Trains (covered by other requirements).
- Engines without cars.
- Locals, road switchers and work trains that do not operate on grades listed in system special instructions or on a continuous grade of 1% or more but less than 2% for a distance of three miles or more.

In the application of this rule, locals, road switchers and work trains are defined as a train that does not exceed 4,000 trailing tons and travels over a distance which can normally be operated by a single crew in a single tour of duty.

B. Providing Emergency Application Capability from Rear of Train

Any one of the following methods fulfills the requirement to provide emergency application capability from the rear of the train:

- An operable two-way end of train telemetry system (HEU/ EOT) which must be armed and tested at point of installation. (See Rule 32.13 for (EOT) installation and testing).
- Distributed power placed on the rear of the train.

- Trains with a manned helper, caboose or passenger equipment at the rear of train equipped with an emergency brake valve and manned with an employee equipped with two-way voice radio communication with the engineer at head end of train.

32.14.1 Loss of Emergency Application Capability from Rear of Train

Trains required to be equipped with rear of train emergency capability as outlined in Rule 32.14 (A) are considered to have an en route failure when one of the following conditions occur:

1. EOT/HEU indicates:

   - Loss of front to rear communication. Message = FR NOCOM.

   - Emergency valve not enabled. Message = NOT ARMD and/or "Emergency Enabled" indicator NOT illuminated.

   - Emergency valve failure or EOT valve failure. Message = VALVFAIL.

     or

   - Battery failure. Message = DEAD BAT, REPL BAT or BATTERY LOW.

2. Loss of communication exceeding 16 minutes 30 seconds as indicated by control console for distributed power locomotive on lead controlling locomotive at head end of train.

3. A loss of voice radio communication between a manned helper, caboose or passenger equipment at the rear of the train and the lead, controlling locomotive.

When an en route failure occurs on trackage other than those listed in timetable special instructions, train must not exceed 30 MPH until failure is corrected or another method of compliance is secured. *Report failure to train dispatcher.*

Exceptions:

- When en route failure occurs due to train being in a location of poor communication (tunnel, rock cut, overpass, etc.), train may be moved a train length in an attempt to regain

communication. If communication cannot be restored after clearing the poor communication area, train must be stopped. The failure must be corrected or alternative method of compliance secured.

- Should a train separation and/or locomotive failure occur while on the ascending grades of the locations described above which require the train to be moved in segments (doubling the hill), it is permissible to move the head portion of the train without emergency capability at the rear of the head portion being moved.

- If a loss of voice radio communication occurs between a manned helper, caboose or passenger equipment at the rear of the train and the lead, controlling locomotive, while on descending grade, train may continue until clearing the grade as long as train is being properly controlled not exceeding 5 MPH above maximum authorized speed.

All train crew members on train operating on grades in above table must take action to stop train, with an emergency application of the brakes should train exceed 5 MPH over maximum authorized speed.

In the event of a need to utilize the emergency feature of the EOT, the command to initiate an emergency must be attempted even if no communications is indicated at the HEU.

32.15 Running Air Brake Test

32.15.1 Procedure for Running Air Brake Test

Conduct a running air brake test where required as follows:

1. Begin the running test of the brakes as soon as train speed is high enough to prevent stalling.

2. While using enough power to keep the train stretched:

   a. Apply the train brakes with enough force to make sure the train brakes are operating properly.

   b. Keep the locomotive brakes released during the test.
   c. Verify that the train brakes create a noticeable retarding force.

3. If the train brakes are operating properly, release the brakes and proceed.

Note: Do not apply the locomotive or dynamic brakes during a running test. If the train fails this test, stop immediately and make repairs.

32.15.2 Required Braking During Inclement Weather

During inclement weather conditions which may cause snow or ice build up to occur between brake shoes and wheels, and train is approaching:

- A meeting, passing or waiting point, speed restriction, or approaching a descending grade.

  or

- A signal indication which will require the train to stop.

The engineer must make a brake pipe reduction sufficiently in advance of that location to allow any accumulation of ice or snow to melt from brake shoes before braking is necessary.

If brakes do not provide sufficient braking effort, the train must be stopped by a full service brake application and full dynamic braking effort. If braking effort still does not appear to be sufficient, the locomotive engineer must make an emergency brake application without hesitation. After stop is made, train must be inspected to determine if brake rigging and shoes are free of snow and ice before proceeding.

32.16 Wheel Slip Warning Light

If the wheel slip light comes on reduce the power or dynamic brake retardation until the light goes out. If the light does not go out:

- Stop the locomotive immediately and make sure the wheels are rotating freely.
- If the wheels rotate freely and the wheel slip light remains on during throttle reduction, isolate the locomotive unit affected.
- If the wheels do not rotate freely, notify the dispatcher and set out the locomotive if safe to do so.

WARNING: A wheel slip light continuously illuminated for 6-8 seconds or longer at speeds above 15 MPH may indicate a locked wheel or a slipped pinion gear. Should this occur, stop and determine that all wheels rotate freely. A slipped pinion gear is indicated by traction motor rotation while locomotive is stopped and under load.

32.17 Dynamic Brake Warning Light

If the Dynamic Brake Warning Light comes on reduce the dynamic brake retardation until the light goes out. If the condition continues, cut out the dynamic brake on the affected unit .

Note: Report all dynamic brake defects to train dispatcher or Mechanical Desk and properly tag locomotive.

32.18 Unusual Conditions

Recognize the proper procedures for unusual train handling conditions.

32.18.1 Unusual Changes in Brake Pipe Pressure

The engineer must stop and secure the train if:

- An abnormal change in or loss of brake pipe pressure occurs with the train brakes released and a normal gradient established. Refer to Rule 33.6.1 concerning minimum brake pipe pressure at rear of train.

  or

- A brake application cannot be transmitted.

32.18.2 Increased Air Brake System Leakage En Route

For trains with air brakes tested by the Air Flow Method, stop the train and repair the brake system if both of the following occur:

1. Brake pipe air flow or brake pipe gradient increases.
2. The air flow pointer does not return to a reading below 60 CFM or below the calibration mark within the appropriate time.

Note: If you cannot repair the brake system to reduce leakage within the required limits, proceed with caution. However, proceed only if the brake pipe pressure on the rear car is at least 60 psi.

32.18.3 Reporting Unusual Air Brake Conditions

Follow this process when reporting unusual air brake conditions:

1. The person reporting must notify the train dispatcher or the Mechanical Help Desk immediately of any unusual air brake condition that affects safe train movement.
2. The dispatcher must then notify the appropriate supervisor.
3. Supervisor assisting will determine if the train can be moved safely or if it must be held for inspection.

32.19 Train Separation Report

After a train separation occurs, notify the dispatcher or mechanical help desk by radio and complete a written Train Separation Report.

32.20 Fuel Conservation - Engine Shutdown

To conserve fuel, on the lead locomotive consist shut down trailing diesel engines to be left standing unattended for 1 hour or longer. In addition, the lead diesel engine may also be shut down when authorized by local supervisors as follows:

- In yards.
- At designated locomotive servicing and repair areas.
- On Locals and Road Switchers when left at the normal tie-up point.

However, leave all diesel engines running if the outside temperature is expected to drop below 40 degrees F during the duration of the shutdown.

If the lead locomotive unit has less than 500 gallons of fuel remaining, notify the train dispatcher or yardmaster of this fact before leaving the locomotive unattended. If the lead unit is not running, leave one trailing unit running.

Contact the train dispatcher, yardmaster, or other authority for information concerning the expected length of the shutdown or the expected temperature during the shutdown.

32.20.1 Weak Batteries

Tag locomotives with weak batteries to prevent shutdown until the condition is corrected.

32.20.2 Shutdown Procedure

Follow this procedure to shut down a locomotive:

1. Make sure the independent brake is operative and fully applied.
2. Place the generator field switch OFF.
3. Place switches or breakers for air conditioning, lights, heaters, refrigerator, and other accessories in the OFF position.
4. Set the hand brake.
5. Remove and stow the reverser handle.
6. Move the engine control switch (isolation switch) to the START/STOP/ISOLATE position.
7. After the engine has been at idle for at least 10 minutes, press the ENGINE STOP button located in the locomotive cab until the engine stops.

   However, if the engine has been in throttle 4 or below for at least 15 minutes, the 10-minute wait is not required.
8. Wait 5 minutes after the engine stops, then open the main battery switch. (This allows for turbo lubrication during "rundown" on engines so equipped.)

32.20.3 Starting Procedure

Follow this procedure to start a locomotive:

1. Check the cooling water level.
2. Check that governor low oil button, over-speed trip, and low water and crankcase protective devices are in the NORMAL or RESET position.
3. On GE units, push the fuel pump reset button, if required.
4. Check that switches or breakers for air conditioning, lights, heaters, refrigerator, and other accessories are in the OFF position.
5. Ensure that the fuel pump breaker is ON.
6. Check that the fuel pump (engine run) and control switches on the engineer's control console are ON.
7. Make sure the engine control switch (isolation switch) is in the START/STOP/ISOLATE position.
8. Close the main battery switch.
9. Pull the injector control lever (layshaft) back to the NO FUEL position, and rotate the engine at least two revolutions using the start switch. If the engine becomes hard to rotate:
    a. Do not attempt to start the engine.
    b. Open the main battery switch and tag the isolation switch.
10. Prime the engine as follows:
    a. On engines with a FUEL PRIME/ENGINE START switch, place the switch in the PRIME position until the sight glass is filled with fuel (no bubbles) or until the fuel pressure gauge stabilizes.
    b. Observe the fuel flow in the fuel sight glass, when equipped (if dual sight glasses are present, the one nearer the engine block should fill with fuel).

11. Crank the engine, not longer than 20 seconds, until the engine starts (crank GE engines for 45 seconds). On engines so equipped:

    a. Hold the injector control lever (layshaft) at 1/3 of its travel while cranking.

    b. Release the lever when the engine comes up to speed.

    c. Allow 2 minutes between cranking attempts.

12. Place switches or breakers for air conditioning, lights, heaters, refrigerator, and other accessories in the ON position, as appropriate.

13. Check that the air brake system is charged and operative before releasing the hand brake.

14. When the locomotive is ready for service, place the engine control switch (isolation switch) in the RUN position.

The starting procedure used by mechanical personnel may include more steps than those stated above.

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33.0 Train Handling

Locomotive engineers must exercise judgment and plan ahead to operate their train safely and efficiently. The engineer is responsible for properly controlling the slack in the train. Good train handling requires the proper combination of throttle modulation, dynamic braking, and air braking to:

- Protect yourself and others from injury.
- Prevent damage to the track structure and equipment.
- Protect lading.
- Use the most fuel-efficient method consistent with good train handling.
- Controlling and limiting in-train forces is essential for safe train operation. Unless an emergency or other condition requires immediate speed reduction, change throttle positions and dynamic and air brake applications slowly to allow slack to adjust gradually. Many locomotives can produce higher tractive effort than the average train's draft gear and couplers can withstand.

High retarding force during dynamic braking can cause excessive buff forces. To limit these forces, observe dynamic braking limitations.

33.1 Train Status Information

Train crewmembers must discuss with the engineer, train status or other conditions affecting train movement. It is the engineer's responsibility to ensure slack changes are controlled, through the use of the throttle, dynamic, automatic and independent air brakes while moving in forward or reverse direction. This would include some or all of the following:

- Train makeup.
- Train length and tonnage.
- Tons per operative brake.
- Speed.
- Severity of the grade.
- Block signal spacing.

- Type and axle limitations (power and dynamic brake).
- Temperature and weather conditions.
- Throttle response.
- Amount and type of slack in the train.

33.2 Dynamic Braking

Dynamic Brake Ground Rules

- To prevent a surge of dynamic braking and allow for electrical current decay, pause for 10 seconds before changing from power to dynamic braking.
- Do not supplement the dynamic brake with the locomotive brakes unless in the process of starting or stopping and speed is below the effective range of the dynamic brakes in your locomotive consist.
- The locomotive brake should never be relied on to control speed in lieu of an effective dynamic brake.
- Extended range dynamic brakes must be utilized to their fullest extent.

33.2.1 Dynamic Brake Limitations

High buff force generated by dynamic brake retarding force may cause a derailment or damage the track structure. Therefore, limit dynamic brake retarding force as follows:

1. Limit the total operative dynamic brake to 28 equivalent dynamic brake axles (EDBA). Loaded and empty bulk commodity unit trains may have 33 EDBA.

   Exception: Trains with remote and/or manned helper locomotive consists entrained or at the rear of the train may have the maximum allowable dynamic brake axles for each locomotive consist placed within the train.

2. Limit the dynamic brake retarding force by cutting out the dynamic brake on the trailing locomotive(s) using the dynamic brake cutout switch or the dynamic brake selector switch on the control panel.

3. The preferred option is to cut out the basic dynamic brake(s) on a trailing locomotive(s).

4. When approaching and operating through turnouts or disturbed track areas with train's air brakes released, use the dynamic brake handle position to limit retarding force to 50 percent of maximum (dynamic brake handle position number 4). Continue to limit the braking effort until at least half the train has passed the restricted area. At speeds of 10 MPH or less, this limitation applies only if 12 axles or more of extended range dynamic brakes are being utilized.

33.3 Use Of Automatic Brake

33.3.1 Applying or Reapplying Automatic Brakes

When applying or reapplying automatic brakes, make brake pipe reductions according to these guidelines:

1. Make an initial brake pipe reduction as follows:

- For a fully charged system, reduce the brake pipe at least 6 psi.
  or
- For an undercharged system, following a release, reduce the brake pipe 5 psi below the previous reduction.

2. Use split reductions for planned slowdowns and stops. Make an initial reduction of 6 to 8 psi followed by additional reductions in 2 to 3 psi increments spaced 30 seconds apart.

3. Make a final reduction when operating conditions permit as train is nearing a stop to prevent a run out of slack. A final reduction is a brake pipe reduction made in such a way as to result in brake pipe pressure exhausting as the train comes to a stop.

33.3.2 Delayed Departure

Observe the following when train is stopped and movement is delayed.

- When operating conditions allow, leave brakes applied or apply brakes with at least a 10 psi brake pipe reduction anytime a train is stopped. Do not release brakes until the train is ready to proceed.

Note: An example of an operating condition that may not allow brakes to remain applied until ready to depart or no increase in brake pipe reduction after stopping would be when near a long, descending heavy or mountain grade and brake system requires full charge before proceeding.

- If required to release brakes, such as during a train inspection, brakes must be reapplied and released prior to departing.

- Closely observe equalizing reservoir pressure when brakes are applied and if leakage occurs, report to mechanical help desk and make a locomotive defect report at first opportunity.

Before starting a train that has been stopped for any period of time, verify brake pipe continuity as follows:

- While observing gages, release the brakes (unless due to grade conditions the recommended train handling practice is to start the train with brakes remaining applied) and observe an increase in brake pipe pressure on the EOT device prior to moving the train.

- A brake pipe pressure reduction at the end of the train with no corresponding brake pipe reduction made at the head end of the train, as indicated by end of train telemetry, may indicate a possible blockage in the brake pipe. Cause of blockage, if any, must be determined.

- If the train is not equipped with an operative EOT device or when an EOT communication failure has occurred, observe horsepower requirements when starting. If excessive tractive effort is needed (based on existing conditions) to start the train, inspect the train to determine the cause.

- If a blockage is suspected, if safe to do so, movement may be made for the train's length not exceeding 10 MPH. Distance may be extended if public crossings or bridges not equipped with walkways are involved. Visual observation of a set and release of brakes at the rear car is sufficient in determining no blockage exists. Dispatcher must be notified of a failed EOT to avoid additional stops and delays, when possible.

If operating with a distributed power consist that is equipped with the automatic Train Check feature at the rear of the train, use it to verify brake pipe continuity.

- If not equipped with the Train Check feature, cut out the brake valve on the controlling DP unit of each remote consist, make a 10 pound brake pipe reduction, restore each remote consist to "Normal," then release the brakes and observe an increase in brake pipe pressure on the rear remote consist or EOT, whichever is at the rear of the train.

- The relieving crew must perform this test on distributed power consists at crew change locations, regardless of advice from the crew relieved that the test was performed.

33.3.3 Releasing Brakes

To release the brakes at slow speeds, use judgment and evaluate the following conditions before attempting a running release of the automatic brakes:

- Train speed.
- Train makeup.
- Temperature.
- Physical characteristics of territory.

Attempting a running release at very low speeds may damage equipment, lading, or track.

When operating conditions allow releasing the brakes:

1. Increase the brake pipe reduction to 10 psi.
2. Allow the exhaust at the automatic brake valve to stop before releasing the train brakes.

When a train brake application is in effect with pressure maintaining equipment, do not move the automatic brake valve handle toward RELEASE unless a brake release is desired.

33.3.4 Use of Automatic Brakes During Cold Weather Conditions

During extreme cold weather (below zero degrees) when operating conditions and outstanding instructions permit, throttle manipulations and dynamic braking must be used in lieu of train air brakes whenever possible in controlling and stopping freight trains.

33.4 Throttle and Reverser Positions

1. Do not apply power to hold a train stationary on a grade.

   Exceptions: 1. May be used when loading bulk Commodity Unit Trains,

   2. Do not apply power to hold a train stationary on a grade, unless all locomotive units in the consist are AC locomotives.

2. Reverser handle must not be moved to any position other than in the direction of travel while locomotive is moving.

3. The generator field switch must never be closed or moved to the "ON" position with the throttle open.

33.4.1 Short Time Ratings

A. Short Time Rating

Short time rating limits on DC locomotives apply to high amperage levels in any throttle position. A rating plate is located near the load meter and gives the time limits for operating locomotives at various amperage levels. Always stay within the time limits indicated by the rating plate on the lead, controlling locomotive. (AC locomotives do not require short time rating protection, and newer DC locomotives without short time rating plates are protected by computer software from overheating. Computer-protected locomotives include EMD-type GP/SD60 and above and GE-type C/B40 and above.)

B. More Than One Consecutive Short Time Rating

When operating a locomotive consist at more than one consecutive short time rate:

1. Do not operate the locomotive continuously for more than the maximum time of any one short time rating without stopping to cool traction motors.

   Example: Do not operate a locomotive at the 1/4 hour rating for 1/4 hour, then at the 1/2 hour rating for 1/2 hour, then at the 1 hour rating for 1 hour, etc.

2. If the locomotive exceeds the short time rating indicated on the rating plate, stop train and double the train over the grade or allow traction motors time to cool before continuing, unless otherwise instructed.

3. To provide for sufficient cooling of traction motors allow the locomotive a minimum of 20 minutes without a short time event.

33.4.2 Minimum Continuous Speed

Minimum continuous speed is the slowest speed at which a DC locomotive can operate continuously in Throttle 8. Locomotive traction motors operating under these conditions develop the highest amperage possible before overheating. The minimum continuous speed varies and is indicated by the rating plate on the locomotive.

33.5 Independent Brake (Locomotive Brake)

When using the independent brake, do the following:

1. The independent brake valve on the controlling unit must be cut in at all times and the handle must not be blocked in ACTUATE position.

2. When it is desired to prevent the locomotive brakes from applying during an automatic brake application, the independent brake valve handle must be actuated (bailed) in RELEASE position a minimum of two seconds per locomotive prior to the automatic brake application and held in ACTUATE position until exhaust ceases.

3. The independent brake must not be applied while power or dynamic brake is being used, except when starting or stopping while in the dynamic brake mode and speed is below the effective range of the dynamic brakes being used. Light independent brake may be used to control wheel slips at speeds below 10 MPH only. Do not use independent brake to control train speed when operating over 15 MPH, unless otherwise authorized.

4. When conditions require the independent brakes to be applied, brake cylinder pressure must be controlled to prevent overheating or sliding of the locomotive wheels, excessive slack action and high in-train forces. The independent brake must not be used when the same results can be obtained with the dynamic brake.

5. When controlling the independent brake during an emergency brake application, place the independent brake handle to the desired position in the APPLICATION ZONE that will develop sufficient pressure, without sliding the locomotive wheels, while at the same time placing the handle in the ACTUATE position. When emergency brake cylinder pressure is desired, release the handle from the ACTUATE position.

6. Remote locomotive engineers must closely observe brake pipe gauge in order to appropriately react to either a service or emergency brake pipe reduction and control locomotive brakes as necessary.

7. The maximum independent brake cylinder pressure designed for each locomotive type must never be exceeded.

   EXCEPTION: When emergency braking is necessary to protect life or property, use the maximum braking effort available.

33.6 Train Handling Scenarios

Use the train handling methods for starting, stopping, slowing, and controlling trains as well as unplanned stopping. These methods are guidelines. Heavy tonnage, heavy grades, or specific locations may require other combinations of throttle modulation, dynamic braking, or air braking.

33.6.1 Starting Train

Locomotives equipped with automatic engine start/stop systems may have shut down if locomotives have been inactive for a sufficient period of time. Before attempting to start a train, place reverser lever in the direction of travel and momentarily open throttle to Run 1 to trigger their start up. After waiting a minimum of two minutes, start train as follows:

- Use the lowest throttle position possible to start the train moving. It may be necessary to retard starting acceleration by use of the locomotive brake.

- Allow the locomotive load to stabilize before advancing the throttle to the next higher position.

- Once the train is moving, do not increase the throttle until either the amperage or the tractive effort stabilizes.

- To accelerate, advance the throttle slowly, one notch at a time.

- In curved territory, use only enough power to start the train. Regulate amperage to reduce the possibility of string-lining in curves because of excessive lateral forces.

A. Starting, Level Grade

When starting the train on a level grade:

1. Release the automatic brake.

2. After the brakes have released on the entire train, move the throttle to RUN 1 and release the independent brake. If the locomotive moves too rapidly in RUN 1, control surge with the independent brake. If the train does not move, slowly advance the throttle.

3. Use the lowest possible throttle position to minimize in-train forces.

   Note: If the train does not move in RUN 4, return the throttle to IDLE, apply the independent brake, and determine the cause.

4. After the train starts to move, check to see if the amperage or tractive effort levels are stabilizing. If these levels are stabilizing, you may advance the throttle to the next higher position.

B. Starting, Ascending Grade

When starting the train on an ascending grade with slack stretched:

1. Advance the throttle to a position to hold the train.

2. Release the automatic brake.

3. Reduce the independent brake sufficiently to allow gradual movement.

4. As the brakes release toward the rear of the train, it may be necessary to advance the throttle to the next higher position to start the train moving.

5. Slowly reduce the independent brake until it is fully released. If the train will not start, consider doubling or getting helpers. Applying power on a standing locomotive longer than necessary will damage DC traction motors.

6. After the train starts to move, check to see if the amperage or tractive effort levels are stabilizing. If these levels are stabilizing, you may advance the throttle to the next higher position.

7. Observe the load meter/tractive effort and limit the throttle position if necessary to avoid high draft forces.

C. Starting, Descending Grade

When starting the train on a descending grade:

1. Ensure that the independent brake is fully applied.

2. Activate the dynamic brake to full.

3. Release the automatic brake and wait for all brakes to release and slack to adjust. On heavy descending grades the automatic brakes may remain applied.

4. Reduce the independent brake until the train begins to move gradually.

5. Once the entire train is moving, gradually reduce the independent brake to avoid abrupt changes in slack.

6. Slowly release the independent brake when the dynamic brake becomes effective.

33.6.2 Cresting a Grade

A train cresting a grade:

- When speed is less than 20 MPH.

- Using 16 or more equivalent axles of head-end power must gradually reduce throttle on lead locomotive consist as the head of train crests the grade to a position that will prevent a speed increase until at least one-half of the train has crested the grade. On heavy descending grades see Item 8 of the System Special Instructions.

Note: This reduction in throttle outlined above includes trains being operated with remote or manned helpers.

33.6.3 Slowing or Controlling Speed

When slowing or controlling train speed, the following methods should be utilized and are listed in preferred order when operating conditions allow and for best fuel efficiency:

1. Throttle modulation. Coast braking when conditions allow.
2. Dynamic braking.
3. Dynamic braking supplemented with train air brakes.

When using dynamic and air brakes and the desired speed has been reached, maintain enough dynamic brake to control slack until the train brakes are fully released.

When using the stretch braking method and the desired speed has been reached, reduce the throttle until train brakes are fully released.

When operating in curved territory, keep the total braking effort at the lowest practical level.

A. Slowing/Controlling Speed, Level or Descending Grade, with Dynamic Brakes, Slack Bunched

When slowing or controlling speed on level or descending grade with dynamic brakes and slack bunched do the following:

1. If in power, gradually reduce the throttle to IDLE.
2. Wait 10 seconds.
3. Activate the dynamic brake and gradually bunch the slack.
4. Increase braking to the desired level. If the dynamic brake alone will slow or control the speed sufficiently, do not use the train brakes.
5. At a sufficient distance from the speed restriction, make a minimum brake pipe reduction and actuate.
6. Make further split reduction(s) as needed and actuate.

7. When the speed is controlled and the automatic brake is released, maintain enough dynamic braking to keep the slack bunched until the brakes release throughout the train.

B. Slowing/Controlling Speed, Level or Descending Grade, without Dynamic Brakes, Slack Bunched

When slowing or controlling speed on level or descending grade without dynamic brakes with slack bunched, do the following:

1. If in power, gradually reduce the throttle to IDLE.
2. At a sufficient distance from the restriction, make a minimum brake pipe reduction and actuate.
3. Make further split reduction(s) as needed and actuate.
4. When the speed is controlled, release the automatic brakes.
5. As the train brakes release, keep the locomotive brakes released unless they are needed to avoid severe slack changes.

Note: Before attempting a running release, consider the train makeup and speed. You may need to stop completely or choose an alternate braking method.

C. Slowing/Controlling, Ascending Grade, Slack Stretched, Throttle Reduction

When slowing or controlling speed on ascending grade, do the following:

1. Gradually reduce the throttle one notch at a time.
2. Maintain a slack-stretched condition.
3. Allow the ascending grade to slow the train.

D. Slowing/Controlling While Cresting Grade, Throttle Reduction Method

When slowing or controlling speed approaching a crest:

1. Reduce the throttle before the locomotive crests the grade.

2. Continue to reduce the throttle to keep the speed from increasing until at least half the train has crested the grade.

3. When in DP operations, operate in the independent mode, reduce throttle on lead consist. As trailing DP consist crests the grade, reduce throttle on remotes consistent with good train handling.

E. Slowing or Controlling Speed, Undulating Grade or Sag, Throttle Modulation Method

When slowing or controlling speed on undulating grade or sag:

1. As you approach the sag, reduce the throttle as necessary to control train speed.

2. Reduce the throttle further as the head end of the train begins descending.

3. Just before the head end of the train reaches the ascending grade, increase the throttle.

4. Continue to increase the throttle as the train ascends the grade.

5. Reduce the throttle as the rear of the train approaches the ascending grade.

F. Stretch Braking

Stretch braking is permitted only where more fuel efficient methods will not provide the necessary control of train speed. When necessary to use stretch braking, exceeding throttle position 4 is prohibited. When it becomes necessary to apply the train brakes while in power, observe the following:

1. Make the desired throttle adjustment sufficiently in advance to allow the slack to adjust.

2. After the slack has adjusted, make a minimum brake pipe reduction and actuate.

3. Reduce the throttle when amperage or tractive effort increases from the effect of the brake pipe reduction. If a portion of the train is on a grade the drawbar force may increase rapidly, requiring further throttle reduction(s).

4. Make additional brake pipe reductions and actuate as necessary.

Note: If the entire train is on a descending grade and the train brakes must remain applied, it is permissible to use limited power to control train speed. Do not exceed throttle position 4, reducing throttle as necessary to prevent excessive amperage or tractive effort.

33.6.4 Stopping

A. Stopping, Level or Descending Grade with Dynamic Brakes Available, Slack Bunched

When stopping on level or descending grade with dynamic brakes available with slack bunched:

1. Gradually reduce the throttle to IDLE.

2. Wait 10 seconds.

3. Activate the dynamic brake and gradually bunch the slack.

4. Increase braking to the desired level.

5. At a sufficient distance from the stop, make a minimum brake pipe reduction and actuate.

6. Make further split reduction(s) as needed and actuate.

7. As speed drops below dynamic brake range, supplement with the independent brake.

8. Make a final brake pipe reduction and allow the locomotive brakes to apply.

B. Stopping, Level, or Descending Grade, No Dynamic Brakes, Slack Bunched

When stopping on level or descending grade with no dynamic brakes:

1. If in power, gradually reduce the throttle to IDLE.
2. Wait for the slack to adjust.
3. At a sufficient distance from the stop, make a minimum brake pipe reduction and actuate.
4. Make further split reduction(s) as needed and actuate. Allow locomotive develop draft forces.
5. As the train comes to a stop, make a final brake pipe reduction and allow the locomotive brakes to apply.

C. Stopping, Ascending Grade, Slack Stretched, Throttle Modulation Method

When stopping on an ascending grade using throttle modulation method:

1. Gradually reduce the throttle one notch at a time.
2. Maintain a slack stretched condition and allow the ascending grade to slow the train.
3. When the train stalls, place the independent brake in FULL APPLICATION.
4. After the independent brake is fully applied, reduce the throttle to IDLE.
5. Apply train brakes as the train stops or just before it stops if immediate movement after stopping is not anticipated.

33.6.5 Unplanned Stop - Non Emergency

In order to stop in the shortest possible distance without using an emergency brake application, such as when encountering a sudden block signal change or when being signaled to stop by a flagman or other person, the following procedure must be followed:

1. Make a brake pipe reduction immediately before making a throttle change.

2. After the initial brake pipe reduction and train slack has adjusted, throttle must be gradually reduced to IDLE position.

3. The independent brake must not be allowed to apply while still applying power.

33.6.6 Shoving Movements

During shoving movements to avoid jackknifing, wheel climb, or rail turnover use extreme care when applying tractive effort. When exceeding 12 equivalent axles of power during shoving movements, use only the minimum amount of tractive effort necessary to begin movement.

A. Starting Reverse/Shoving, Level or Ascending Grade

When starting a reverse or shoving movement on a level or ascending grade:

1. Release the automatic brake and wait for all brakes to release and slack to adjust.

2. Reduce the independent brake and use the lowest possible throttle position to start the movement.

3. As speed increases, continue to reduce the independent brake until it is fully released.

4. If you notice a significant increase in the amp meter/tractive effort or if train speed slows without a change in throttle position, stop immediately and determine the cause.

B. Starting Reverse/Shoving, Descending Grade, Slack Stretched

When starting a reverse or shoving movement on a descending grade with slack stretched:

1. Ensure that the independent brake is fully applied.

2. Activate the dynamic brake to full.

3. Release the automatic brake and wait for all brakes to release and slack to adjust.

4. Reduce the independent brake gradually as the train begins to move.

5. Slowly release the independent brake when the dynamic brake becomes effective.

C. Starting Reverse/Shoving, Descending Grade, Slack Bunched or Unknown

When starting a reverse or shoving movement on a descending grade with slack bunched or slack condition unknown:

1. Activate dynamic brake.

2. Reduce the independent brake by 50 percent to allow the locomotive to begin moving as slack adjusts.

3. Release the automatic brake and wait for all brakes to release and slack to adjust.

4. Continue to reduce the independent brake gradually as the train begins to move.

5. Slowly release the independent brake when the dynamic brake becomes effective.

D. Stopping Reverse/Shoving on Ascending Grade, Slack Bunched

When stopping a reverse or shoving movement on an ascending grade with the slack bunched, do the following:

1. Use the lowest possible throttle position to maintain a slack bunched condition.

2. At a sufficient distance from the stop, make a minimum brake pipe reduction and actuate.

3. Make further split reduction(s) as needed and actuate.

4. Observe the amp meter/tractive effort and reduce the throttle as necessary to avoid high buff forces.

5. As the train stops, place the independent brake in FULL APPLICATION.

6. After the independent brake is applied, reduce the throttle to IDLE.

E. Stopping Reverse/Shoving, Level or Descending Grade, Slack Stretched

When stopping a reverse or shoving movement on level or descending grade with the slack stretched, do the following:

1. If in power, gradually reduce the throttle to IDLE and allow the slack to adjust.

2. Wait 10 seconds.

3. Activate the dynamic brake. If the dynamic brake is unavailable or ineffective, use the independent brake to maintain a slack-stretched condition.

4. Gradually increase braking to the desired level.

5. At a sufficient distance from the stop, make a minimum brake pipe reduction and actuate.

6. If needed, make further split reduction(s) and actuate.

7. As speed drops below the dynamic brake range, supplement with the independent brake.

8. Make a final brake pipe reduction and allow the locomotive brakes to apply.

33.6.7 Moving Over Railroad Crossing At Grade

When moving at speeds of 25 MPH or more over a railroad crossing at grade (diamond):

1. At least 8 seconds before the locomotive reaches the crossing, reduce the throttle to RUN 4 (or lower if the throttle is already positioned in RUN 4 or lower).

2. Wait until the entire locomotive consist passes over the crossing before advancing the throttle.

33.7 Grade Operation

33.7.1 Stopping on a Grade

When stopping on a grade, the following need to be considered:

1. Train speed largely determines the amount of braking distance needed to stop, ensure maximum train speed is not exceeded while operating on a grade.

2. When conditions warrant, use all available braking power. If you are not sure that a service brake application will control the speed of the train, make an emergency brake application without hesitation.

3. Early in the braking process, achieve a balance between the level of dynamic brake and the level of air brake needed to control train speed on a descending grade.

4. At speeds below 10 MPH, use extended range dynamic brakes, if available. Extended range dynamic brakes provide more retarding force than locomotive brakes.

33.7.2 Recharging on a Grade

If the independent brakes may not hold the train on a grade, recharge the air brake system as follows:

1. Apply a sufficient number of hand brakes.

2. Release the automatic brake.

3. Recharge the air brake system.

4. After recharging the system, make a sufficient brake pipe reduction to hold the train while releasing the hand brakes.

Note: Do not apply power to hold a train stationary on a grade, unless all locomotive units in the consist are AC locomotives.

33.7.3 Cresting a Mountain Grade

Before passing the summit of a mountain grade, observe the following, see System Special Instructions, Item 8, for further instructions:

1. Ensure that the rear car brake pipe pressure is within 15 pounds of the regulating valve setting.

2. Abnormal brake pipe pressure changes, loss of brake pipe pressure, an abnormal increase in air flow reading, etc.

Note: If brake pipe pressure is dropping at the rear of train or a brake pipe rise is noted, stop and secure the train. Correct the problem before proceeding.

33.7.4 Balance Braking on Grade

When a constant level of braking is required for long distances do the following:

1. Make a minimum brake pipe reduction and make further reductions of 2 psi until the train maintains the desired speed.

2. Limit the effective brake pipe reduction to 18 psi or less. If a greater than 18 psi brake pipe reduction is required to control train speed, stop train and inspect to determine reason before proceeding.

3. If the equalizing reservoir leaks and pressure maintaining is required for long distances, place the automatic brake valve cutout valve in PASSENGER, if equipped. Do not move the automatic brake valve cutout valve from FRT to PASS unless the automatic brake valve is in the RELEASE position. When operating in PASSENGER, use extreme care. Any movement of the automatic brake valve handle toward RELEASE will release the brakes throughout the train.

33.7.5 Distributed Power, Descending Grade Exceeding 1.8 Percent

When operating distributed power train consists in the independent mode on descending grade of 1.8 Percent or more, do not exceed 100K's tractive effort for all units in remote consist.

Example: Two unit rear remote consist, do not exceed 50K's on controlling remote.

33.7.6 Regulating Valve Braking

Do not use the regulating valve to brake the train.

33.7.7 Retaining Valves

Use retaining valves when required by the timetable, general order or when requested by the engineer.

At locations not designated by timetable or general order, use retaining valves where the conductor or engineer thinks they are needed to control the train properly.

A. Setting Retaining Valves

To set retaining valves:

1. Stop the train.
2. Set the retaining valves as specified by the timetable or general order. Set all retaining valves.
3. Use **High** Pressure Position, except use **Low** Pressure Position on empty cars if equipped. **Slow Direct** Position must not be used.
4. Notify the engineer of the number of retainers set before proceeding.

B. Operating With Retainers

After the retaining valves are set, brake cylinder pressure is not retained until a brake pipe reduction and release has been made.

When retainers are set in HP (High Pressure) a 20 psi brake cylinder pressure will be retained or in LP (Low Pressure) a 10 psi brake cylinder pressure will be retained only after a brake pipe reduction of at least 10 psi has been made and released. Further brake pipe reductions will add to the pressure in the brake cylinder.

The short-cycle method of braking must be used. This method consists of making frequent automatic brake applications and short holds of the application. If brake pipe pressure is gradually reducing and cannot be restored at slower train speed, and brake pipe reduction reaches 18 psi, **TRAIN MUST BE STOPPED**, and air brake system recharged.

Do not exceed 15 MPH when operating with retaining valves set.

When retaining valves are not in use, place them in EX (Exhaust). Ensure that cars picked up en route have retaining valves in EX (Exhaust).

33.8 Emergency Brake Applications

When conditions warrant, use an emergency brake application without hesitation if any condition occurs in which there is doubt that service applications can control train speed. Make an emergency brake application by moving the automatic brake valve handle quickly to EMERGENCY and leave it there until the train or locomotive stops. In addition, lift the red cover of the EMERGENCY SWITCH and activate the emergency valve on the end-of-train device (EOT) utilizing the head-of-train (HEU) telemetry device, if equipped.

Use the following procedure when stopping from an emergency application:

1. Move the independent handle to a position in the application zone that will develop the desired brake cylinder pressure without sliding wheels or developing excessive buff or draft force, then actuate and hold the handle in the actuate position. Extra care must be used to prevent sliding wheels if in dynamic brake mode at the time of emergency application.
2. Adjust brake cylinder pressure by moving the handle in the application zone while actuating.
3. If in power, return throttle to idle.
4. When maximum locomotive brake cylinder pressure is desired, release the handle from the actuate position.

5. After stopping and once freight car vent valves have closed (approximately 60 seconds), if operating conditions permit, place automatic brake valve in RELEASE position to release brakes.

33.8.1 Emergency Brake Application by Crew Member

A crew member must initiate an emergency brake application, without hesitation, when:

- Life or property is in danger.

  or

- The engineer does not respond to warnings or signals to reduce train speed or stop the train.

The trainman must know the location of the emergency air brake valves, and when making the emergency brake application must:

1. Notify other employees that an emergency brake application is in effect.

2. Determine if the emergency brake application is in effect on the entire train.

33.8.2 Undesired Emergency Brake Application

When an undesired emergency (UDE) brake application occurs, move the automatic brake valve handle to EMERGENCY and wait until the train stops. After stopping, if operating conditions permit, place the automatic brake valve handle in RELEASE to release the brakes and help locate the air hose separation or other problem. Promptly notify dispatcher of the occurrence.

33.8.3 Unintentional Brake Release

If an unintentional brake release occurs while the brakes are applied, stop the train and ascertain the cause before proceeding. Promptly notify dispatcher of the occurrence.

33.9 Penalty Brake Application

A penalty brake application is initiated by one of the following safety control devices:

- Alertness Device.

- Overspeed.
- Cab Signal.
- Distributed Power failures.

When a penalty brake application occurs, observe the following procedures:

1. Move automatic brake valve handle to SUPPRESSION position.
2. Control the amount of independent brake cylinder pressure desired, if any, by moving handle into the application zone and actuating. (If in power, return throttle to IDLE position).
3. Reset PCS after train stops.
4. After PCS closes, release brakes if operating conditions allow.

33.9.1 Slow Train

To slow the train when the safety control device sounds a warning, comply with the following:

1. On locomotives with 26L, 30CDW, and CCB brake equipment, move the automatic brake handle to SUPPRESSION within the 6- to 12-second warning period.
2. On locomotives with other brake equipment, reduce the brake pipe pressure 6 to 8 psi, or more if necessary.

33.9.2 Recover

To recover when the overspeed control applies the train brakes:

1. On locomotives with 26L, 30CDW, and CCB brake equipment, move the automatic brake handle to SUPPRESSION.
2. On locomotives with other brake equipment, move the automatic brake handle to LAP.
3. Move the throttle to IDLE and wait 60 seconds.
4. After the train stops, move the automatic brake handle to RELEASE and note that:
    - Brake pipe pressure is being restored.

- PC light goes out.
- Brakes release.

Note: Some locomotive equipment has been modified to slow the train during the warning period with the automatic brake valve in MINIMUM REDUCTION. Unless the engineer knows that the locomotive being operated includes this modification, the SUPPRESSION position should be used.

33.10 Switching Movements

When switching cars, follow these switching movement requirements:

1. When starting or stopping switching movements, gradually stretch or bunch slack.
2. When using multiple locomotives, limit buff and draft forces.
3. Under normal conditions, make switching movements without using the automatic air brake system.
4. If necessary, cut in sufficient freight car air brakes to control switching movements.
5. Reverser handle must not be moved to any position other than in the direction of travel while locomotive is moving.
6. The generator field switch must never be closed or moved to the "ON" position with the throttle open.

33.11 Temporary Speed Restrictions

When moving through an area with a temporary speed restriction, do the following:

1. If possible, release train air brakes and dynamic brakes before entering the restricted area.
2. Use the lowest possible throttle position for running or starting.
3. Avoid or minimize changes in train speed or slack condition.
4. Limit independent brake cylinder pressure as much as possible.

33.12 Disturbed Track

When track work has affected track stability, a track bulletin or other instruction may be issued by the proper authority stating, "between certain limits", engineers must handle their trains according to Rule 33.6.7.

When proceeding through the limits of the track bulletin or wherever instructed, the engineer must use the following train handling techniques to minimize in-train forces when possible:

- Use throttle modulation or low dynamic brake amperage.
- Avoid making slack adjustments.
- Avoid applying or releasing automatic brakes.
- Make power and brake adjustments before or after the restriction.
- If operating with distributed power at the rear of the train on:
  - Level or ascending grades, operate in synchronous mode with low throttle settings, or operate in independent mode with distributed power 1-3 throttle positions below the lead consist.
  - Descending grades, operate in synchronous mode with low dynamic brake settings, or operate in independent mode with distributed power 1-3 dynamic brake positions above the lead consist.

33.13 Thermal Misalignment

When an obvious thermal misalignment is observed ahead of a moving train, the train must be stopped, if possible, prior to the lead locomotive passing over the misaligned track. If the train cannot be stopped in time with service applications, to minimize additional buff forces imparted on the track, the preferred method for train handling is as follows:

- When the train is equipped with a 2-way EOT, stop the train using the emergency toggle switch on the HED to place the train into emergency from the rear end. Control slack as described in Rule 33.8.

- When the train is equipped with distributed power at the rear of the train, stop the train using a full service brake application. Control slack as described in Rule 33.8.

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34.0 Freight Car and Locomotive Components

34.1 Freight Car End and Platform Identification

Identify car ends as follows:

- On cars with one hand brake, the "B" end of the car is the end with the hand brake. The other end is the "A" end.
- On cars with more than one hand brake, the letters "A" and "B" are stenciled on the appropriate ends of the car.
- On cars with more than one platform, each section if stenciled. Example: A five-platform articulated spine car is designated with an "A" platform on one end and the adjacent platform is designated as "E" then "D", then "C" and then "B" on the opposite end.

34.2 Wheel and Journal Identification on Cars

To determine the correct wheel numbers on cars:

1. Face the "B" end of the car.
2. From the "B" end of the car, identify the designation of wheels, journals, and axles as follows:
   - Axles are designated from the "B" end of the car with "1" for the axle closest to the "B" end.
   - Wheels and journals are designated left or right as viewed from the "B" end.
   - Specific wheels are identified using the axle and wheel designation.

34.3 Coupler Assemblies

American railroads use three types of coupler assemblies. Each coupler head and knuckle is marked with a letter indicating its type; E, F and H.

34.4 Freight Car A-1 Reduction Relay Valve

Some long cars have an A-1 reduction relay valve that helps transmit a service or emergency brake pipe reduction by compensating for the added brake pipe length of the car.

The relay valve functions as follows:

- Service brake reductions are assisted through the B-1 quick service portion.
- Emergency brake pipe reductions are transmitted by the No. 8 vent valve portion. If the No. 8 vent valve fails to reset after an emergency brake application, causing a continuous blow at the exhaust port, plug the valve by removing the vent protector and screwing in the threaded plug.

The following freight cars are equipped with the relay valve:

- Cars with AB or ABD control valves and more than 75 feet of brake pipe between hose couplings.
- Cars with ABDW control valves and more than 100 feet of brake pipe between hose couplings.

Note: Cars with ABDW control valves having between 75 and 100 feet of brake pipe have a No. 8 vent valve added.

34.5 Freight Car Automatic Vent Valve

Some multi-platform cars are equipped with what is known as an automatic vent valve (AVV), which is an emergency portion of a control valve. This valve is used only to propagate an emergency brake application through the brake pipe. Should an AVV become defective, the cutout cock is used to cut it out.

34.6 Retaining Valves

The retaining valve on each car controls the brake cylinder pressure exhaust. All freight cars have retaining valves located at the "B" end of the car or at the side near the control valve. The retaining valve can be positioned to function as follows during a brake release:

- Allow the exhaust of brake cylinder pressure to atmosphere.
- Retain brake cylinder pressure while the system is recharged.

34.6.1 Three-Position Retaining Valve

The three-position retaining valve includes these positions:

- DIRECT EXHAUST (EX)-Exhausts all brake cylinder pressure. Handle is turned down.
- HIGH PRESSURE (HP)-Exhausts brake cylinder pressure to 20 psi. Handle is 45 degrees below horizontal.
- SLOW DIRECT EXHAUST (SD)-Exhausts brake cylinder pressure for a blow down time of approximately 86 seconds and continues to exhaust until all pressure is vented. Handle is 45 degrees above horizontal.

34.6.2 Four-Position Retaining Valve

The four-position retaining valve includes the positions listed above and one additional position:

- LOW PRESSURE (LP)-Exhausts brake cylinder pressure to 10 psi. Handle is horizontal.

34.7 Locomotive Brake Equipment

Description of the various automatic and independent brake valve positions and their function. (Brake valve handle positions are described from left to right, or from front to back if desktop mounted.)

34.7.1 Automatic Brake Valves

A. H6 Automatic Brake Valve

The H6 automatic brake valve is a non-maintaining, non-self-lapping type automatic brake valve normally found on older locomotives and some switch engines. Handle positions include:

RELEASE. Charges the brake system and releases the brakes.

LAP. Prevents air from leaving or entering the brake pipe at the automatic brake valve. All ports in the brake valve are closed. Brake pipe leakage will continue to reduce brake pipe pressure at the same rate as the leakage. This position is also used for conducting brake pipe leakage tests and recovering from a penalty application.

SERVICE. Reduces equalizing reservoir pressure and brake pipe pressure at a service rate.

EMERGENCY. Vents brake pipe pressure directly to the atmosphere, causing brakes to apply at an emergency rate.

B. 24RL-MC Automatic Brake Valve

The 24RL-MC automatic brake valve is a maintaining, non-self-lapping automatic brake valve. This brake valve maintains in LAP. Therefore, cut out the maintaining feature during brake pipe leakage tests. Handle positions include:

FULL RELEASE. Releases the train and locomotive brakes and charges the brake pipe through the regulating valve, preventing overcharge. When the handle is in this position, air is heard exhausting at the brake valve.

RELEASE. Releases the train and locomotive brakes and charges the brake pipe through the regulating valve.

FIRST SERVICE. Reduces the equalizing reservoir 6 to 10 psi at a service rate, then continues to reduce brake pipe pressure at a slow rate.

LAP. Maintains brake pipe pressure at the same level as equalizing reservoir pressure.

SERVICE. Reduces equalizing reservoir and brake pipe pressures at a service rate.

EMERGENCY. Vents brake pipe pressure directly to the atmosphere, causing brakes to apply at an emergency rate.

C. 24RL-MC1 Automatic Brake Valve

The 24RL-MC1 automatic brake valve is a maintaining, non-self-lapping automatic brake valve. This brake valve maintains in MAINTAINING. Use LAP during brake pipe leakage tests. Handle positions include:

FULL RELEASE. Releases the train and locomotive brakes and charges the brake pipe through the regulating valve, preventing overcharge. When the

handle is in this position, air is heard exhausting at the brake valve.

RELEASE. Releases the train and locomotive brakes and charges the brake pipe through the regulating valve.

MAINTAINING. Maintains brake pipe pressure at the same level as equalizing reservoir pressure. After making a brake pipe reduction, maintain brake pipe pressure by returning the automatic brake handle to MAINTAINING without pausing in LAP.

Note: Pausing in LAP may allow leakage to reduce brake pipe pressure below equalizing reservoir pressure. The brakes will release when you return the handle to MAINTAINING if equalizing reservoir pressure is above brake pipe pressure.

LAP. Prevents air from leaving or entering the brake pipe at the automatic brake valve. All ports in the brake valve are closed. Brake pipe leakage will continue to reduce brake pipe pressure at the same rate as the leakage. This position is also used for conducting brake pipe leakage tests and recovering from a penalty application.

SERVICE. Reduces the equalizing reservoir and brake pipe pressures at a service rate.

EMERGENCY. Vents brake pipe pressure directly to the atmosphere, causing brakes to apply at an emergency rate.

D. 26C, 30CDW, Knorr CCB and WABCO EPIC Automatic Brake Valves

These maintaining, self-lapping brake valves regulate brake pipe pressure, controlling both locomotive and train brakes.

Brake Valve Features

These automatic brake valves have these features:

- The maintaining feature maintains constant brake pipe pressure unless the cutout valve is in OUT.

- The regulating valve controls the supply of air pressure to the equalizing reservoir, which regulates brake pipe pressure.

Handle Positions

RELEASE. Charges the brake pipe to the regulating valve setting and releases the locomotive and train brakes.

MINIMUM REDUCTION. Reduces equalizing reservoir and brake pipe pressures 6 to 8 psi.

SERVICE ZONE. Gradually reduces equalizing reservoir and brake pipe pressures in increasing amounts as the brake handle is moved to the right.

- Moving the brake handle to the left with the brake valve cutout valve in PASS will increase equalizing reservoir and brake pipe pressures.

- Use extreme care when operating freight trains with the automatic brake valve cutout valve in PASS.

FULL SERVICE POSITION

Reduces equalizing reservoir and brake pipe pressures to near equalization.

SUPPRESSION. Restores control of the locomotive after a safety control (penalty) brake application. To recover control, leave the brake handle in this position for 60 seconds. Moving the brake handle farther to the right toward HANDLE OFF/CONTINUOUS SERVICE. Reduces equalizing reservoir and brake pipe pressures at a service rate. Use this handle position for:

- Trailing locomotives

- Helper locomotives that do not control the air brake system

- Locomotives hauled dead-in-train

EMERGENCY. Vents brake pipe pressure directly to the atmosphere, causing brakes to apply at an emergency rate.

34.7.2 Automatic Brake Valve Cutout Valve

The automatic brake valve cutout valve determines how and when the automatic brake controls brake pipe pressure.

There are two-position and three-position cutout valves. Because the cutout valve handle is spring-loaded, push it in before changing positions.

Note: EMERGENCY is always available regardless of the position of the automatic brake valve cutout valve.

Two-Position Cutout Valve

The two-position cutout valve has these positions:

IN. Provides control of brake pipe pressure from the automatic brake valve. Equalizing reservoir and brake pipe pressures will increase when the automatic brake valve is in RELEASE.

OUT. Disconnects control of brake pipe pressure from the automatic brake valve. Use this position when:

- Not using the automatic brake valve to control brake pipe pressure (trailing locomotives or locomotives hauled dead-in-tow)
- Conducting brake pipe leakage tests

Three-Position Cutout Valve

The three-position cutout valve has these positions:

FRT. Same as IN position described in two-position cutout valve above.

OUT. Same as OUT position described in two-position cutout valve above.

PASS. Provides control of brake pipe pressure from the automatic brake valve. Equalizing reservoir pressure and brake pipe pressure will increase from any movement of the brake handle toward RELEASE. Use this position when operating passenger or commuter trains to utilize the graduated release feature.

Note: In freight service, if the equalizing reservoir is leaking, PASS may be used only if it is necessary to maintain constant brake pipe pressure during an automatic brake application. Because of the possibility of an undesired release, placing the three-position cutout valve in PASS position must only be done with the automatic brake valve handle in RELEASE position.

34.7.3 Independent Brake Valves

The following describes the positions and functions of all independent brake valves including:

LA6-P (Used with H6 automatic brake valves).

S40 (Used with all 24RL brake equipment).

SA26 (Used with 26C automatic brake valves).

30CDW.

Knorr CCB.

WABCO EPIC.

RELEASE/ACTUATE. Normal position to release the locomotive brakes. To release the locomotive brakes while an automatic brake application is in effect, depress the handle (or lift actuating ring) while it is in the RELEASE position (actuate).

APPLICATION ZONE. All handle movements between RELEASE and FULL APPLICATION increase or decrease locomotive brake cylinder pressure as follows:

1. Increase by moving the brake handle to the right (or forward).
2. Decrease by moving the brake handle to the left (or back towards operator).

FULL APPLICATION. Position for creating maximum locomotive brake cylinder pressure from the independent brake system.

34.7.4 MU-2A/Double-Ported Cutout Cock

The handle for the MU-2A cutout cock is spring-loaded; push it in before changing positions.

The MU-2A valve has three positions:

LEAD or DEAD. Engages control of the independent brakes. Use when a locomotive is a single unit, a controlling unit, or is being hauled dead-in-tow.

TRAIL 6 or 26. Disconnects control of the independent brakes from the independent brake valve. Use when a locomotive is a trailing unit in a multiple-unit consist.

TRAIL 24. Disconnects control of the independent brakes from the independent brake valve. Use when a locomotive is a trailing unit in a multiple-unit consist.

The double-ported cutout cock has two positions:

IN. Engages control of the independent brakes on a single locomotive or on the controlling locomotive of a multiple-unit consist. Use IN also when a locomotive is hauled dead-in-tow.

OUT. Disconnects control of the independent brakes from the independent brake valve. Use OUT when a locomotive is trailing in a multiple-unit consist.

34.8 Electropneumatic Automatic and Independent Brake Valves

(Knorr CCB or WABCO EPIC) Electropneumatic automatic and independent brake valves (Knorr CCB or WABCO EPIC) are cut in or cut out through electronic display screens. The air brake setup screens options are:

Independent Brake:
1. Lead.
   or
2. Trail.

Automatic Brake Valve:
1. Pass (passenger-to be used only in passenger service).
2. Freight.
   or
3. Cut Out.

Note: To avoid an undesired emergency brake application when cutting in the automatic brake on these systems, cut in the independent brake first by selecting "Lead" and saving changes before changing automatic brake valve setup to "Freight" (or "Pass"). Most units now have graceful cut in eliminating this problem.

34.9 Locomotive Electronic Air Brake Computer Resets Resetting CCB Faults

Knorr CCB systems may sometimes detect a system fault enroute or when setting up that may be cleared as follows:

1. Secure locomotive.
2. Close end cocks on affected unit, including main reservoir line.
3. Verify that air brake computer (CCB) circuit breaker is closed and remove reverser handle.
4. Set unit air brake setup to TRAIL. Note: If unit will not go to TRAIL, select LEAD, save and confirm. Try Step 4 again.
5. Place automatic brake valve handle in EMERGENCY position.
6. Place independent brake valve handle in RELEASE position.
7. After 60 seconds, place automatic brake valve handle in RELEASE position.
8. Change air brake setup to LEAD-CUT IN, and charge brake pipe to 90 psi.
9. Place automatic brake valve handle in SUPPRESSION position for 10 seconds.
10. Return automatic brake valve handle to RELEASE position. Allow equalizing reservoir and brake pipe to FULLY charge and allow brake cylinder pressure to go to 0 psi.
11. Place independent brake valve handle in FULL APPLICATION position.
12. Place independent brake valve handle in RELEASE position.
13. ACTUATE (BAIL) for 10 seconds.
14. Place automatic brake valve handle in EMERGENCY position.

15. After 60 seconds, place automatic brake valve handle in RELEASE position.

16. Place independent brake valve handle in FULL APPLICATION position.

17. Faults should be cleared. If faults do not clear, follow message instructions on operator's display.

34.10 Air Flow Meter

The air flow meter measures the rate in cubic feet per minute (CFM) that air flows into the brake pipe. The Air Flow Method (see Rule 30.9.1) uses this meter to determine brake pipe leakage.

34.10.1 Air Flow Meter Readings

The air flow meter provides the following brake pipe flow information:

- As the brake system begins charging, a high flow into the brake pipe is indicated by:

  a. Higher numbers (more than 60 CFM).

  or

  b. The pointer moving to the right.

- As the brake system becomes charged, a lesser air flow into the brake pipe is indicated by:

  a. Lower numbers (less than 60 CFM).

  or

  b. The pointer moving to the left.

- If the air flow meter shows a reading (less than 60 CFM or left of the calibration mark) that is stabilized, the brake system is charged.

The air flow meter also provides the following information about the train's brake system:

- After a brake application and release, the air flow meter will indicate high flow. As the brake system recharges, the brake pipe flow rate will decrease until the air flow pointer reaches the reference value, indicating that the brake system is recharged.

- Air flow less than the reference value may indicate a closed angle cock.

- Air flow greater than the reference value may indicate increased leakage to the brake system.

- With a brake application in effect, a decrease in air flow may indicate that an unintentional brake release is occurring.

34.10.2 Engineer Responsibilities

Once the air flow meter shows a constant reading, the engineer should:

1. Note the rate of flow and use this number as a reference to determine when the brake system is charged.

2. If the air flow meter is equipped, adjust the reference pointer to agree with the flow pointer.

Note: This reading is a reference value to use to monitor fluctuations in air flow to the brake pipe.

34.11 Charging Time Chart

When the brake system is uncharged and not equipped with an air flow meter, use the following chart to determine the minimum and maximum charging times:

Minimum and Maximum Charging Times When Brake System is Empty		
Brake Pipe Length (in feet)	**Minimum Charging Time** (Minutes)	**Maximum Charging Time** (Minutes)
2500 or less	8	25
3000	10	30
4000	15	35
5000	20	40
6000	26	55
7000	35	65
8000	45	75
9000	57	100
10,000	71	125
11,000	80	160

34.12 Electronic Alertness Device

An electronic alertness device stops the train with a service rate brake application if the engineer does not respond properly. The device functions as follows:

1. The device begins functioning when locomotive brake cylinder pressure falls below 25 psi.
2. At this point, the device monitors the operator's alertness.
3. It resets when the operator changes the position of or operates one of these locomotive controls:
   - Throttle.
   - Horn.
   - Bell.
   - Dynamic brake.

or

- Device reset button.

Note: Radio transmission (on some alerter types)

4. If the device is not reset within the reset cycle (varies relative to speed):
   - A warning light flashes.
   - A warning horn sounds on and off for 10 seconds and then continuously for 10 seconds.
5. If the device is not reset within 20 seconds after the warning light and horn begin operating, the train brakes will automatically be applied at a service rate (Penalty Brake).

34.12.1 Deactivate Device Temporarily

To deactivate the electronic alertness device temporarily for unit train loading/unloading:

- **UPRR Locomotives** (this feature only available on some models)

  Observe the following steps:

  1. Close throttle.
  2. Center reverser.
  3. Place remote consist(s) in REMOTE MODE IDLE, if DP train.
  4. Isolate controlling locomotive.
  5. Open generator switch.

  Note: As long as speed remains below 2 MPH, alerter is nullified.

- **BNSF** and other railroad's locomotives.

  Observe the following steps:

  1. WARNING: If distributed power train, first place remote consist(s) in REMOTE MODE - IDLE to prevent

undesired loading of remote consist during loading/unloading operation.

2. Isolate all units in the LEAD consist except the controlling unit. (Controlling unit will be isolated after completing all steps below.)

3. Select slow speed control on operating screen. (Leave speed setting to lowest speed setting available or 0 MPH)

4. Move reverser to the direction of travel.

5. Open throttle as commanded if using Slow Speed to load or Run 1 to simply nullify alerter during automatic car positioner unloading operation.

Isolate lead unit, if only nullifying alerter with Slow Speed feature active.

Release independent brakes when ready for movement.

Note: Alerter is nullified as long as train movement does not exceed 4 MPH.

- If the above steps do not nullify alerter, complete the following steps:

A. On 26C, 30CDW Equipped Locomotives

1. Cut out the automatic brake valve.

2. Adjust the regulating valve to 114 psi.

3. Move the automatic brake valve handle to SUPPRESSION.

4. Cut in the automatic brake valve to PASS.

5. Make sure the brake pipe pressure is at the required 90 psi.

B. Restore Electronic Alertness Device Control on 26C and 30CDW

To restore the electronic alertness device control:

1. Cut out the automatic brake.
2. Move the automatic brake handle to RELEASE.
3. Adjust the regulating valve to the required pressure.
4. Cut in the automatic brake.

C. CCB Equipped Locomotives

When the locomotive is in SLOW SPEED operation, if equipped, the electronic alertness device does not function below 5 MPH.

D. Epic Equipped Locomotives

Plug into the MU receptacle

34.13 Overspeed Control

The over speed control prevents the train from running at speeds higher than the safe mechanical limits of the traction motors. It functions as follows:

- If train speed increases to an unsafe level, the safety control device sounds a warning.
- If the train does not slow within 6 to 12 seconds of the first warning sound, the overspeed control device applies the train brakes and trips the PC switch.

Exception: Some BNSF locomotives allow an Overspeed Penalty Application to be prevented by placing automatic brake valve to MINIMUM position. When warning whistle is heard, move automatic brake valve to MINIMUM position. If speed reduces sufficiently, train brakes may be released, when desired. If Penalty Brake Application occurs as indicated by PCS open and service brake application, move automatic brake valve handle to SUPPRESSION to recover.

34.13.1 Slowing Train due to Overspeed Application

To slow the train when the safety control device sounds a warning, comply with the following:

1. On locomotives with 26L, 30CDW, and CCB brake equipment, move the automatic brake handle to SUPPRESSION within the 6 to 12 second warning period.

2. On locomotives with other brake equipment, reduce the brake pipe pressure 6 to 8 psi, or more if necessary.

34.13.2 Recover

To recover when the overspeed control applies the train brakes:

1. On locomotives with 26L, 30CDW, and CCB brake equipment, move the automatic brake handle to SUPPRESSION.

2. On locomotives with other brake equipment, move the automatic brake handle to LAP.

3. Move the throttle to IDLE and wait 60 seconds.

4. After the train stops, move the automatic brake handle to RELEASE and note that:

- Brake pipe pressure is restored.
- PC light goes out.
- Brakes release.

Note: Some locomotive equipment has been modified to slow the train during the warning period with the automatic brake valve in MINIMUM REDUCTION. Unless the engineer knows that the locomotive being operated includes this modification, the SUPPRESSION position should be used.

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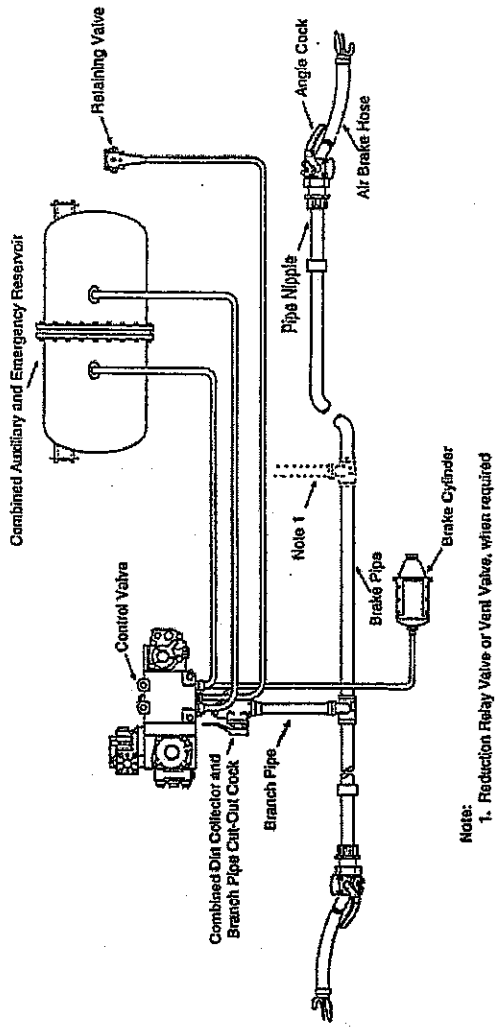
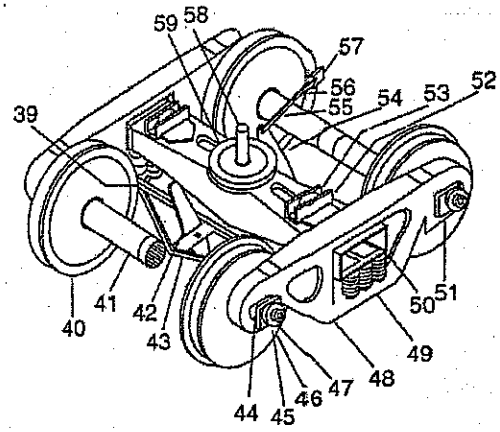
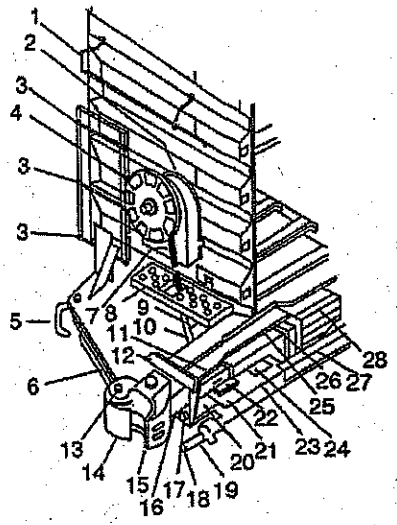
Charts and Diagrams



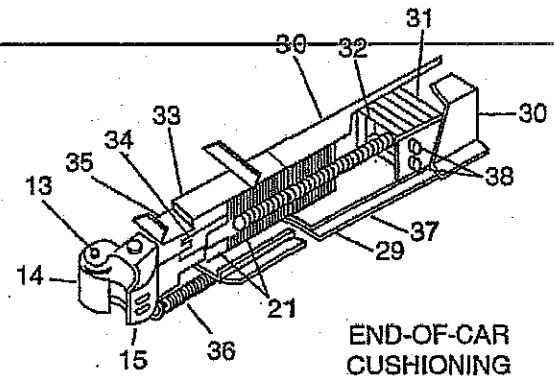
A. Single Capacity Freight Air Brake Equipment
Refer to Chart F for Car Chart Components



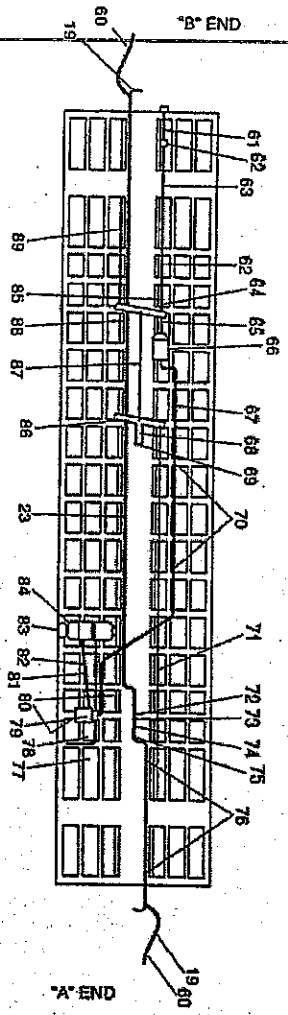
B. Car Chart Figure 1
Refer to Chart F for Car Chart Components



C. Car Chart Figure 2
Refer to Chart F for Car Chart Components



D. Car Char Figure 3
Refer to Chart F for Car Chart Components



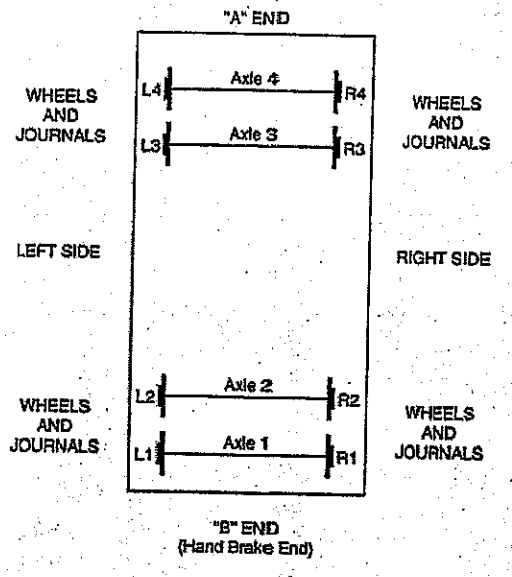
E. Car Chart Figure 4
Refer to Chart F for Car Chart Components

1. Horizontal end hand hold
2. Hand brake housing
3. End ladder tread
4. Hand brake wheel
5. Telescoping uncoupling rod
6. Uncoupling lever guide
7. Hand brake chain
8. End platform (combined crossover and brake step)
9. Bell crank
10. Vertical hand brake rod
11. Front draft gear stop
12. Striker
13. Coupler knuckle pin
14. Coupler knuckle
15. Type E coupler head
16. Coupler carrier
17. Coupler wear plate
18. Striker flange
19. Angle cock
20. Draft key washer
21. Draft key
22. Draft key retainer
23. Brake pipe, 1-1/4" (Train line)
24. Follower block
25. Coupler yoke
26. Draft gear
27. Rear draft gear stop
28. Rear draft gear stop reinforcement
29. Hydraulic piston
30. Center sill
31. Back stop plate
32. Rear lug casting
33. Striker casting
34. Coupler key
35. Cushioning unit
36. Restoring mechanism
37. Inspection plate
38. Rear cross key
39. Brake shoe
40. Wheel
41. Axle
42. Truck live lever
43. Brake beam
44. Roller bearing adapter
45. Roller bearing end cap
46. End cap retaining bolt
47. End cap locking plate
48. Truck side frame
49. Truck spring
50. Truck bolster
51. Roller bearing assembly
52. Truck side bearing roller
53. Truck side bearing housing
54. Truck dead lever
55. Clevis at dead lever
56. Clevis at dead lever fulcrum
57. Dead lever anchor—underframe mounted
58. Center pin
59. Truck center plate cast integral with truck bolster
60. Air hose
61. Hand brake chain at bell crank
62. Hand brake rod guide
63. Hand brake rod
64. Hand brake chain at cylinder
65. Cylinder push rod
66. Air brake cylinder
67. Cylinder pipe, 3/4"
68. Floating lever guide
69. Floating lever
70. Pipe clamp, 3/4"
71. Top rod "A" end
72. Branch pipe tee
73. Branch pipe tee support
74. Combined dirt collector and cutout cock
75. Connection hose
76. Pipe clamp, 1-1/4"
77. Retainer pipe
78. Retainer valve
79. ABD control valve
80. Release rod
81. Auxiliary reservoir pipe, 3/4"
82. Emergency reservoir pipe, 3/4"
83. Reservoir support
84. Combined auxiliary and emergency reservoir
85. Cylinder lever guide
86. Brake lever fulcrum
87. Brake slack adjuster
88. Cylinder lever
89. Top rod "B" end

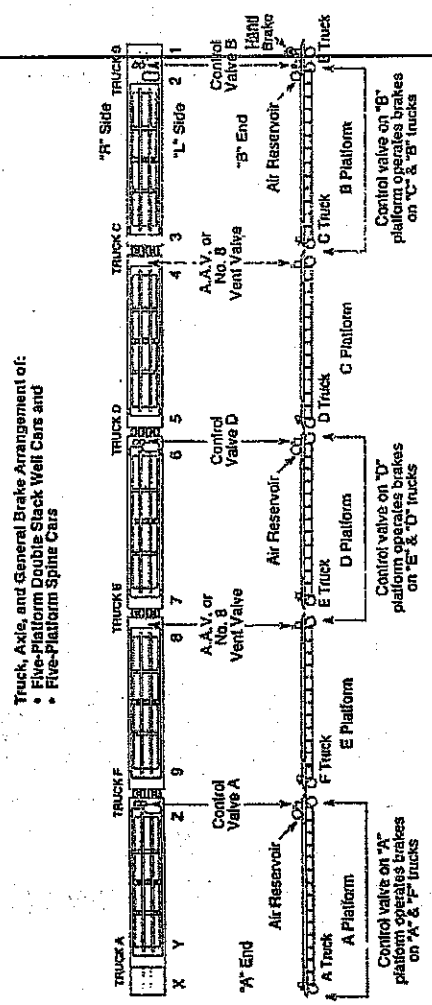
F. Car Chart Components

To determine axle number, journal number and wheel number on a car; stand facing the hand brake end of the car (the "B" end). Count the closest axle as number 1 and the wheels and journals on the right and left sides as R1, R2, *etc.*, and L1, L2, *etc.*, respectively as shown on in the diagram.

Note: For all multi-unit articulated cars, the journal-wheel number is stenciled on the side frame directly above the journal.



G. Freight Car Axle, Journal and Wheel Identification Diagram



H. Articulated Car Identification Diagram

Control Valve

Operates truck/mounted brakes. It consists of two valve portions bolted to a pipe bracket and has a cutout cock. It is located by the air reservoir. Each control valve operates the brakes on two trucks.

- The control valve on the "A" operates the brakes on "A" and "F" trucks.
- The control valve on the "D" operates the brakes on "E" and "D" trucks.
- The control valve on the "B" operates the brakes on "B" and "C" trucks.

A.A.V. (Accelerated Application Valve)

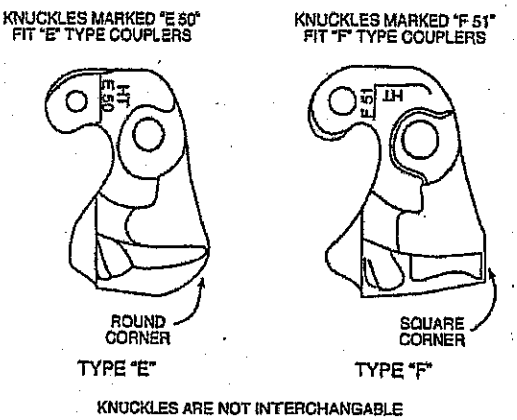
Does not operate brakes, but does propagate the signal to operate brakes. It consists of one valve portion bolted to a pipe bracket and has a cutout cock, However, do not cut out the A.A.V. unless there is a continuous blow of air through the valve.

No. 8 Vent Valve

Does not operate brakes, but does propagate the signal to operate brakes. It consists of a single vent valve and does not have a cutout cock. It does have a plug that can be installed if there is a continuous blow of air through the valve.

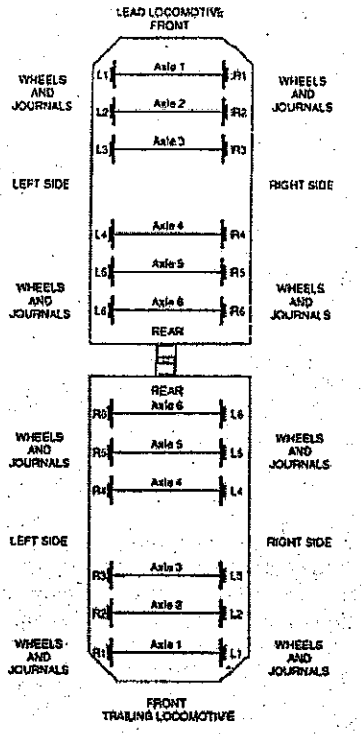
Hand Brakes

Five platform/
well cars have a handbrake on the "B" end platform/well. Also, there may be a hand brake on the "A" end platform/well. When there are handbrakes on both the "A" and "B" platforms/wells, the hand brake usually will be painted orange and/or are stenciled "SECOND HAND BRAKE AT OPPOSITE END".



J. Coupler Diagram

To determine axle number, journal number, and wheel number on a locomotive, stand facing the same direction as the specific locomotive is headed. Count axles from the front of that locomotive as axle one and wheels and journals on the right and left sides as R1, R2, etc., and L1, L2, etc., respectively as shown in the diagram.



K. Locomotive Axle, Journal and Wheel Diagram

GLOSSARY

Accelerometer
An indicator that displays in MPH per minute the rate of increase/decrease of speed.

AC Locomotive
AC locomotives are equipped with AC traction motors and are not affected by maximum continuous current ratings or short time operating ratings.

Actuating
Using of feature of the independent brake valve to charge the actuating pipe from the main reservoir and prevent or release a locomotive brake application from a brake pipe reduction.

Air Brake
A system of compressed air devices, controlled manually, electronically or pneumatically, that make the car or locomotive slow down or stop.

Air Brake Equipment
The equipment that supplies and exhausts air to and from the brake cylinders, but does not include foundation brake gear and hand brakes.

Air Brake Hose
A reinforced tubing. On each car or engine, the tubing is attached to a nipple that screws into the angle cock at the end of the brake pipe. The other end of the hose includes a coupling (glad hand) that fits into an identical coupling on the adjoining car. The complete arrangement connects air between the brake pipes of the cars and the locomotives throughout the train.

Air Brake System
All of the devices for operating air brakes to control the speed of and stop a locomotive or train. The system includes the operating devices, pipes, hoses, fittings, and foundation brake gear.

Air Compressor
A locomotive device, powered by the diesel engine or an electric motor, that compresses air for operating the air brakes and all other air-operated devices on locomotives and cars.

Air Compressor Control Switch
A device that controls the loading and unloading of the compressor at the proper main reservoir pressures.

Air Flow Indicator (AFI)
An instrument that indicates the volume of the air flowing through the automatic brake valve into the brake pipe.

Air Gauge
An instrument that indicates air pressure in pounds per square inch (psi).

Alignment Control Coupler
Specially equipped couplers, installed on most locomotives that only allow the coupler in buff to move laterally within certain limits. This equipment minimizes rail turnover, wheel climb and jackknifing.

Ampere (Amperage, Amps)
The standard unit for measuring electric current.

Angle Cock
A manually operated device located at each end of the brake pipe on locomotives and cars to permit or prevent air flow.

Articulated Multi-platform Car
A car with multiple units (segments) that have articulated couplings and which the units share a common truck.

Automatic Brake Valve
A manually operated electronic controller or pneumatic valve on the locomotive that controls the train and engine brakes.

Auxiliary Reservoir
A storage volume, charged from the brake pipe, to receive and store air to apply brakes on a car or locomotive. In freight car equipment, the auxiliary reservoir and emergency reservoir are combined in one structure.

"B" End (of car)
The end where the hand brake is located unless otherwise identified.

Back-up Valve or Hose
A device, either portable or permanently connected to the brake pipe, that controls brakes from the car that it is attached to. The device can apply the brakes with a service or emergency application.

Balanced Braking
Controlling train speed by making enough of a brake pipe reduction to stabilize speed on a grade, then allowing the automatic brake

valve pressure maintaining feature to hold the brake application constant regardless of brake pipe leakage. This ordinarily is accomplished in combination with dynamic braking.

Bleed (Bleed-off)
Venting air pressure to the atmosphere, such as venting air pressure from the brake cylinder of individual cars, by using the release valve.

Blended Brake
The combination of air and dynamic braking by making an automatic service brake application with the throttle in IDLE.

Brake Application
A brake pipe pressure reduction (no matter how made) that causes the control or distributing valve to move to the service or emergency position.

Brake Cylinder
A metallic cylinder containing a piston. Compressed air forces the piston outward to apply the brakes. When the air pressure is released, the piston returns to its normal position by a release spring coiled around the piston rod inside the cylinder.

Brake Pipe
The section of air brake piping of a car or locomotive that supplies the reservoirs. It also connects the piping to allow the locomotive engineer to control the car brakes. The pipe is 1-1/4 inches in diameter and extends from one end of the car to the other. At the ends, flexible hoses connect the cars. When a train is made up and all brake pipes on the cars are joined together, the entire pipe line is called the brake pipe.

Brake Pipe Gradient
The difference in brake pipe pressure between the locomotive (or source of supply) and the rear car of the train. Brake pipe gradients may be:

Normal Gradient
The gradient that exists when the system is fully charged.

False Gradient
The temporary gradient that exists when the system is less than fully charged (for example, the exaggerated difference between the head end and rear end after a release).

Inverse Gradient
The temporary condition when the brake pipe pressure is higher at the rear of the train than at the head end of the train (for example, during a service brake application).

Brake Pipe Pressure
The amount of pressure in pounds per square inch (psi) in the brake pipe (commonly expressed in pounds).

Brake Valve Cutoff Valve
A device on locomotives that can cut out the charging and service functions of the automatic brake valve. This valve also properly positions the brake valve for passenger or freight operation.

Branch Pipe Cutout Cock
A device on locomotives and cars that isolates the control valve from the brake pipe.

Control Valve
A device on locomotives or cars that charges the reservoirs and applies or releases brake cylinder pressure when brake pipe pressure reduces or increases.

DC Locomotive
DC locomotives are equipped with DC traction motors and are affected by maximum continuous current ratings or short time operating ratings.

Dead Engine Feature
A device near the locomotive control valve that is used when the unit is handled dead-in-train. When the dead engine cutout cock is opened, the main reservoirs are charged from the brake pipe to operate the engine brakes.

Distributed Power
One or more locomotive consists that are remotely controlled from the lead locomotive.

Disturbed Track
A section of passable track that has a temporary speed restriction imposed because various defects or track maintenance has affected the integrity of the track.

Draft Gear
The connection between the coupler rigging and the center sill. This connection receives and cushions the shocks associated with in-train forces or coupling.

Drawbar Forces (In-train Forces)
Forces at the couplers between cars and/or locomotives that may be either draft (stretched) or buff (compressed), depending on train operation.

Dynamic Brake
An electrical device that converts some of the energy developed by a moving locomotive into an effective retarding force.

Dynamic Brake Holding Feature
A feature of the lead, controlling locomotive that allows dynamic braking effort when a PCS open condition exists.

Dynamic Brake Interlock (DBI)
A device that will automatically keep the locomotive brakes from applying when automatic brakes are applied during dynamic braking.

High Capacity Dynamic Brakes
Provide approximately 13,500 lbs. of effort per axle instead of 10,000 lbs. per axle as other dynamic brake systems.

Flat (Grid Control) Dynamic Brake System
A dynamic brake system that provides retardation that is controlled solely by the position of the dynamic brake lever. Maximum retardation occurs at Position 8.

Taper (Speed Control) Dynamic Brakes
A dynamic brake system that provides retardation relative to both speed and dynamic brake handle position. The higher the speed, the greater the retarding force developed for a given handle position. At higher speeds, full dynamic brake effort is reached at Position 4.

Electronic Alertness Control
A safety control system that senses the activity of the engineer. As the engineer goes about normal activities, any such changes will reset the control and start a timing circuit. If, during the timing period, no additional activity is detected, an audible and/or visual alarm occurs. If activity still doesn't occur for another period, approximately 6 seconds, a penalty brake application is initiated.

Electronic Controlled Brakes

An air brake system that can be controlled electronically is referred to as electronically controlled pneumatic brakes or ECP. The ECP systems that are being utilized are overlay brake systems. Overlay means the freight car brake system can be operated in either ECP or conventional pneumatic mode. All cars in the train must be equipped with ECP to operate in the electric mode.

Emergency Application

A rapid reduction of brake pipe pressure that causes the control valves to move to the emergency position and the vent valves to open. This equalizes auxiliary reservoir, emergency reservoir, and brake cylinder pressures.

Emergency Brake Valve

A manually operated device on equipment that initiates an emergency brake application.

Emergency Reservoir

A storage volume, charged from the brake pipe, to receive and store air used during emergency brake applications and certain recharge features.

Empty Bulk Commodity Unit Train

A train made up entirely of empty cars used to transport coal, grain, ore, potash, molten sulfur, soda ash, phosphate rock, oil, taconite or other bulk commodities.

End of Train Telemetry System

Telemetry Components

End-of-train telemetry devices is a radio end-of-train telemetry system that consists of:

- End-of-train device (EOT) mounted on the trailing coupler of the last car.
- Head-of-train device (HEU) mounted in the locomotive.

An EOT (2 way EOT that has **not** been armed), provides:

- Last car brake pipe pressure monitoring.
- Last car motion status (moving or stopped).
- Marker light status (on or off).
- EOT battery status.

- A 2 way EOT that has been armed (emergency enabled), provides:
  - Capability to initiate an emergency brake application at the rear of the train. Both the HEU and EOT must be equipped for two-way communication and the HEU must be armed to the EOT (emergency enabled). An Emergency toggle switch associated with the HEU cab display is used to activate the EOT emergency valve.

  - A 2-way EOT transmits and receives information between the head-end and rear-end units. The additional purpose of a 2-way EOT is to provide a way to initiate from the locomotive an emergency brake application at the rear of the train. For this to happen, both the head-end and the rear-end units must be equipped for two-way communication and armed (emergency enabled). An Emergency toggle switch associated with the EOT cab display is used to activate the EOT emergency valve located on the rear- end unit.

Equalizing Reservoir

A small reservoir connected to a piston or diaphragm chamber and used in automatic air brake operations. It is only cut in on the controlling unit. The reservoir's purpose is to add a volume of air to one side of the chamber, which can be accurately controlled.

When a brake pipe reduction occurs, air is drawn from the equalizing reservoir. The reservoir then automatically draws the proper amount of air from the brake pipe. For this reason, the brake pipe pressure and the equalizing reservoir pressure are always the same, except when they are equalizing after a brake pipe reduction or a brake pipe charging operation.

Foundation Brake Gear

The levers, rods, brake beams, etc. that connect the brake cylinder piston rod to the brake shoes so that when air pressure forces the piston out, the brake shoes are forced against the wheels.

Full Service Application

A brake pipe reduction made only to the point at which the auxiliary reservoir and brake cylinder pressures equalize. Any further reduction in the brake pipe pressure, except an emergency application, will not affect the amount of pressure in the brake cylinder. Therefore, air is being wasted from the brake pipe (over reduction).

The chart below shows the reduction needed for a full-service application for various initial brake pipe pressures. Also listed is the brake cylinder pressure at full service for various initial brake pipe pressures:

Initial Brake Pipe Pressure	Service Equalization Pressure	Brake Pipe Reduction to Obtain Equalization
90 psi	64 psi	26 psi
105 psi	75 psi	30 psi
110 psi	78 psi	32 psi

Grade (of Track)

Grade is other than level track and is usually expressed as a percentage. The percentage is the number of feet the track rises or falls in a distance of 100 feet. For example, a 1-percent ascending grade means that the track rises 1 foot in elevation for every 100 feet the equipment travels on the track. Unsecured rail equipment may roll on a grade.

- Grade designations include the following:
- Light Grade: Less than 1.0 percent.
- Heavy Grade: At least 1.0 percent for a distance of 3 miles or more.
- Mountain Grade: 2.0 percent or greater for a distance of 2 miles or more.

Hand Brake

A mechanical arrangement of levers, chains, rods, gears, and fulcrum. When applied manually by wheel or lever, the hand brake forces the brake shoes against the braking surfaces (wheel tread or disc) to control car or locomotive movement.

Head of Train Device (HEU)

A radio device located in the locomotive cab that communicates with an End of Train Device (EOT). The HEU displays:

- Last car brake pipe pressure.
- Last car motion status (moving or stopped).
- Marker light status (on or off).
- EOT battery status.
- Communication Status with EOT.
- 2-Way Armed Status
- Distance measurement referenced to locomotive movement.

And provides:

- Audible alarms pertaining to status changes.
- Arming capability to a selected 2-way EOT.
- Interface for Manual and Automatic initiated EOT emergencies.

Helper

Distributed power or manned helper added to a train to assist movement.

Horsepower Per Trailing Ton (HPT)

The total horsepower of all working locomotives divided by the total trailing weight of the train in tons. For example, a train powered by 15,000 horsepower and having a trailing weight of 4,285 tons has a 3.5 horsepower per trailing ton ratio (15,000 HP divided by 4,285 tons).

Independent Brake Valve

A brake valve that controls the locomotive brakes independent of the automatic brake valve handle position.

Independent Pressure Switch (IPS)

A device on a locomotive that cancels the extended range portion of dynamic braking or all dynamic braking when a sufficient independent brake application occurs. This switch prevents the locomotive wheels from sliding because of excessive braking.

Interchange
A location where railroads exchange rolling equipment.

Intermodal Equipment
Equipment designed to carry trailers, containers, automobiles.

Intermodal Trains
Trains made up of entirely of intermodal equipment.

Isolation Switch
A switch on diesel electric locomotives that has two or three positions. In the RUN position, the unit is "on the line," responds to control, and develops power. In the ISOLATION (or Stop-Start) position, the unit is isolated from the consist and does not develop power or respond to control.

Linking
The process of electronically connecting the controlling lead unit to the controlling distributed power unit on a distributed power train.

Light Locomotive
One or more units, with or without a caboose, not coupled to cars.

Loaded Bulk Commodity Unit Train
A train made up entirely of loads of coal, grain, ore, potash, molten sulfur, soda ash, phosphate rock, oil, taconite or other bulk commodities.

Main Reservoir
An air reservoir on the locomotive for storing and cooling compressed air.

Minimum Continuous Speed
Minimum continuous speed is the slowest speed at which a DC locomotive can operate continuously in Throttle 8. Locomotive traction motors operating under these conditions develop the highest amperage possible before overheating. The minimum continuous speed varies and is indicated by the rating plate on the locomotive.

Minimum Reduction
The first position of the automatic brake valve that initiates a service application of 6 to 8 psi.

Manned Helper
A helper controlled by an engineer in the controlling unit of the locomotive helper consist.

MU Cutout Cock (MU-2-A, Dual-Ported Cutout Cock)
A device for cutting in or out the independent brake valve.

Non-articulated Multi-platform Cars
A car with multiple units (segments) that are connected with solid drawbars. Each unit is a stand-alone unit and does not share a common truck with another unit.

Off Air
Not connected to a continuous source of compressed air of at least 60 pounds per square inch (psi).

Overcharge
Brake equipment charged to a higher pressure than the regulating valve is adjusted for or can maintain. In such a condition, brakes on a portion of the train may not release.

Penalty Brake Application
An automatic full service brake application caused by various safety devices.

Pneumatic Control Switch (PCS)
An air-operated switch, activated by an emergency or penalty brake application, that drops the engine speed to idle on EMD locomotives or throttle notch 1 on GE locomotives.

Pressure Maintaining Braking
Controlling train speed by making enough of a brake pipe reduction to stabilize speed on a grade, then allowing the automatic brake valve pressure maintaining feature to hold the brake application constant regardless of brake pipe leakage.

Pressure Maintaining Feature
A system designed to overcome brake pipe leakage both in the RELEASE and SERVICE positions of the automatic brake valve. This allows a constant brake application to be held as long as needed.

Reduction (of the brake pipe)
A decrease in brake pipe pressure at a rate and of an amount sufficient to cause a train brake application to be initiated or increased.

Reduction Relay Valve
A device on long cars that helps brake pipe pressure reduce during service and emergency brake applications. The valve compensates for the added length of brake pipe on long cars.

Regulating Valve
The valve that reduces air pressure from the locomotive's main reservoir to the desired pressure in the brake pipe. The regulating valve will automatically maintain that pressure when the automatic brake valve is in the RELEASE position.

Retaining Valve
A manually operated valve used on cars to exhaust brake cylinder pressure completely or to maintain a predetermined pressure.

Service Application
When brake pipe pressure exhausts at a service rate to apply the train brakes.

Slack Action
Movement of part of a coupled train at a different speed than another part of the same train.

Slug
A unit with traction motors but no diesel engine and incapable of propelling itself. The unit receives electrical power through a power cable from an adjacent, specially equipped locomotive. Slugs are used where low speeds and high tractive effort are needed.

Solid Block (of cars)
One or more cars coupled together that:

- Are charged or have not been off air for more than 4 hours.
- Have been tested as outlined in Rule 30.10 (Procedure for Inspection and Test).

Thermal Cracks (in wheels)
Cracks in a railroad wheel, normally caused by heat generated on the tread and flange of the wheel from excessive braking.

Throttle Modulation
The action of adjusting the throttle one notch at a time between idle and position 8 to control train speed without the application of air brakes.

Tons per Dynamic Brake Axle

The total gross trailing tonnage of the train divided by the number of axles of locomotives, including helper locomotives, operating in dynamic brake. (Refer to locomotive data tables in system special instructions for dynamic brake axle ratings.

When making this calculation, include in the gross trailing tonnage the weight of any locomotive, including a helper locomotive, not operating in dynamic brake or with dynamic brake cut out.

Tons per Operative Brake

The gross trailing tonnage of the train divided by the total number of cars having operative brakes. For example, a 100-car train with all brakes operating, having a total train weight of 6,000 tons, has 60 tons per operative brake (6,000 tons divided by 100 cars).

Train lists showing average tons per car or platform will equal tons per operative brake when:

- The train list is current (no additional pickups or setouts have been made).
- No brakes have been cut out.
- There is one brake per car or platform (Note: This is not the condition for some equipment, such as articulated intermodal cars).

Transfer Train Movement

A movement of an engine and one or more cars, between a point of origin and a point of final destination of at least 1 mile, but not more than 20 miles.

Unattended

Means cars and/or locomotives left standing and unmanned in such a manner that the brake system of the cars and/or locomotives cannot be readily controlled.

Vent Valve

A valve attached to the brake system of a car or locomotive. The valve responds to an emergency brake pipe pressure rate of reduction by venting the brake pipe at each vehicle to the atmosphere. As a result, the emergency application spreads throughout the train.

Wheel Sliding

When the wheel rotates slower than lengthwise movement dictates.

Wheel Slipping
When the wheel rotates faster than lengthwise movement dictates.

Yard Test Plant
A system of piping and fittings that supplies air at convenient locations to charge and to test cars without a locomotive.